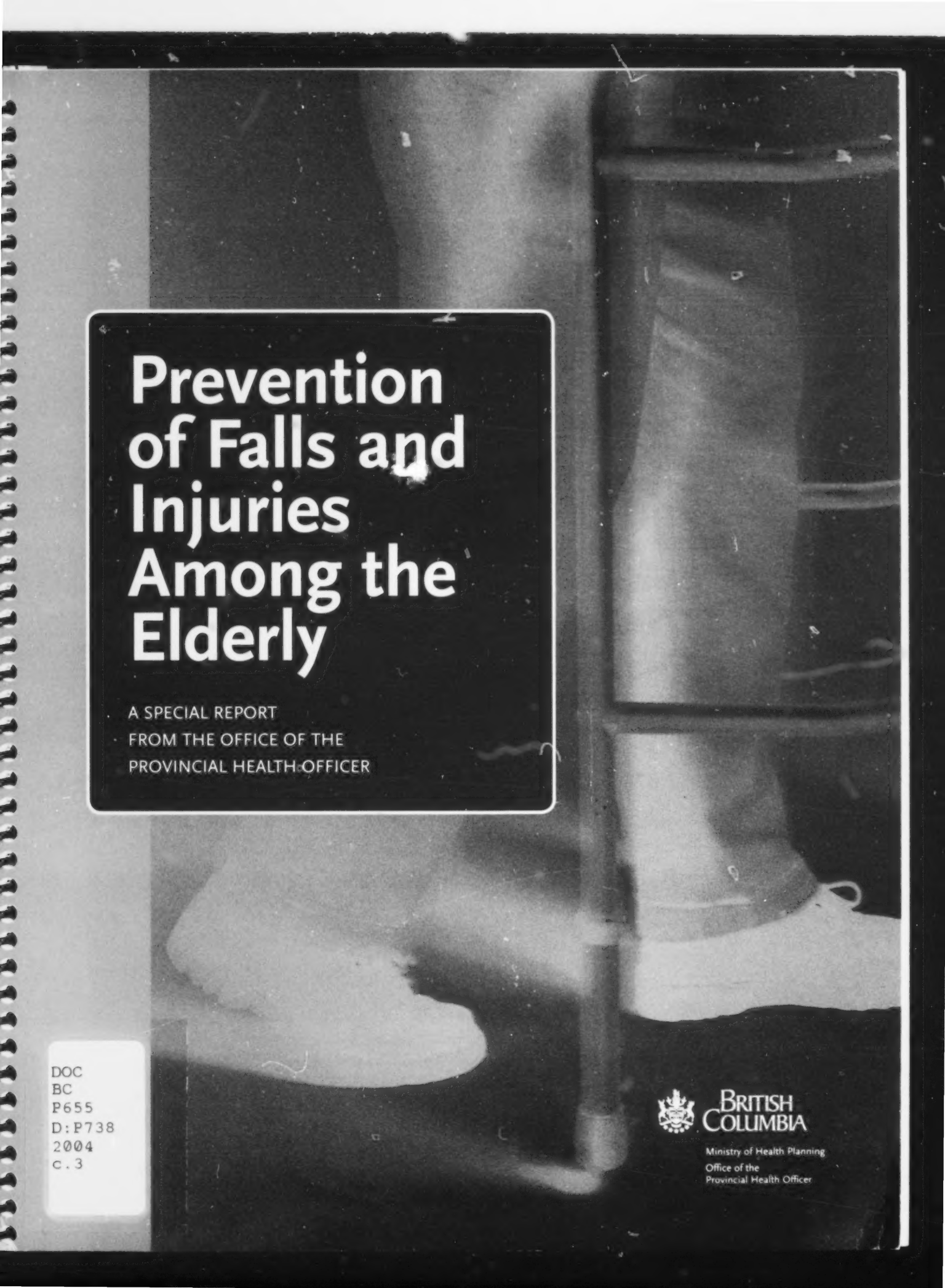

Prevention of Falls and Injuries Among the Elderly

A SPECIAL REPORT
FROM THE OFFICE OF THE
PROVINCIAL HEALTH OFFICER

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BRITISH COLUMBIA
Ministry of Health Planning
Office of the
Provincial Health Officer

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Office of the Provincial Health Officer
B.C. Ministry of Health Planning
4th Floor, 1515 Blanshard Street
Victoria, B.C. V8W 3C8

Telephone: (250) 952-1330
Facsimile: (250) 952-1362

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P.R.W. Kendall MBBS, MSc, FRCPC
PROVINCIAL HEALTH OFFICER

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Highlights

It can happen in an instant: reaching on a wobbly stool for something located on a high shelf, tripping over uneven pavement, slipping on a rug or a patch of ice, or getting up from a bed, a bath, a toilet or a chair. It can happen in a person's home, in the community, while a patient is in an acute care hospital, or as a resident in a long-term care home. There are numerous ways a person can suddenly trip or lose his or her balance, and the result is often an injury, hospitalization – or even death.

It is estimated that one in three persons over the age of 65 is likely to fall at least once each year. In B.C., this means that an estimated 147,000 British Columbians over age 65 are likely to fall this year. Almost half of those who fall experience a minor injury and between 5 to 25 per cent sustain a more serious injury, such as a fracture or a sprain. In 2001 alone, 771 people over the age of 65 died from falls in B.C. and more than 10,000 were hospitalized.

B.C. data show that over the last decade there has been no improvement in the rate of deaths from falls in any of the three age groups over age 65; the death rates have remained consistent. In addition, the number of persons aged 65 years and older admitted to hospital due to a fall-related injury has increased from 9,181 in 1992/93 to 10,242 in 2000/01, with the majority of this increase being accounted for by those age 85 years and older. The impact of falls in this age group is a public health problem of huge proportions that will only intensify as our population ages.

In this report, we outline the impact of falls and the resulting inuries on elderly individuals, their families, and society. We also present new data that confirm the seriousness of this public health concern in British Columbia. We examine the physical, environmental, behavioural and social/economic factors that increase the risk of falling. And we discuss what is known about where and why falls happen in the community, in long-term care homes, and in acute care hospitals. In addition, we examine emerging, evidence based, strategies to prevent, assess and reduce the risks of falls and injuries in all settings, we note gaps in the research information and outline promising new areas for further investigation. Finally, we present a series of recommendations from the Provincial Health Officer, for actions by individuals, seniors' groups, health providers, regional health authorities and the provincial government to help reduce the toll exerted by falls and the resulting injuries upon our elderly population and our society in general.

BURDEN OF INJURY FROM FALLS - NEW B.C. DATA

In this report, we present new epidemiological findings from the Population Health Surveillance and Epidemiology Branch of the B.C. Ministry of Health Planning's analysis of hospital separations, mortality and morbidity data in B.C. that illustrate the huge toll from falls among the elderly.

- In 2001, 771 people over the age of 65 died either directly or indirectly from a fall.
- Due to increasing numbers of elderly people in the province, the absolute numbers of people dying from falls has increased over the last decade, with the largest increase being for those 85 and older. In 2001, approximately 450 people age 85 and older died either indirectly or directly from falls, compared to about 300 in 1990.

- In B.C., for every death that results from a fall among persons aged 65 years and older, there are approximately 34 hospital admissions and 56 visits to the emergency department by people who are treated and released.
- The number of annual hospitalizations for falls for those aged 65 years and older increased from 8,700 hospital separations (cases) in 1992/93 to 10,000 by 2000/01.
- The average length of hospital stay for people who have fallen is 9 days for those aged 65-74, 12.5 days for those 75-85, and 14 days those 85 and older. The length of stay is more than twice as long in each age group for falls than for all other causes of hospitalization for people over the age of 65.
- In 2001 about 3,100 seniors over the age of 65 were hospitalized for a broken hip: about two thirds of these were females.
- Between 1992/1993 and 2000/2001, more than 40,000 seniors in B.C. were hospitalized for a broken hip or femur, accounting for 37.9 per cent of all fall-related injuries treated in hospital.

Evidence from previous studies confirms that the health impact of falls in Canada is substantial.

- Falls are the most common cause of injury among elderly people.
- Falls accounted for 57 per cent of deaths due to injuries among females and 36 per cent of deaths among males, age 65 and older.
- Falls are responsible for 70 per cent of injury-related days of hospital care for elderly people.
- Falls cause more than 90 per cent of all hip fractures in the elderly and 20 per cent of seniors who suffer a hip fracture die within a year. A single hip fracture adds $24,400 to $28,000 in direct health costs to the system. Almost half of people who sustain a hip fracture never recover fully.
- Falls are directly accountable for 40 per cent of all elderly admissions to nursing homes or long-term care facilities.
- Falls among seniors can cause long-term disability, chronic pain, and lingering fear of falling again. The aftermath of pain or fear from a fall can lead seniors to restrict their activities which in turn can increase the risk of falling because of increased muscle weakness, stiffness or loss of coordination or balance.
- Fall-related injury among those 65 and older has been estimated to cost the Canadian economy $2.8 billion a year.

In British Columbia, impacts are also significant.

- Injuries from falls account for 85 per cent of all injuries to the elderly and in 1998 cost the province $180 million in direct health care costs.
- Setting a target in B.C. of a 20 per cent reduction in falls, as measured by current hospitalization rates for falls among the elderly, would lead to 1,400 fewer hospital stays and 350 fewer elderly people disabled. The overall savings of such prevention could amount to $25 million a year in reduced health care costs.

SPOTLIGHT ON PRESCRIPTION MEDICATION IN B.C.

New, highly preliminary research revealed in this report from an analysis of PharmaCare data indicate that elderly individuals who have infections that are being treated with antibiotics may be temporarily at a heightened risk of falls. Seniors who were hospitalized for a fall-related injury were more than five times as likely to have received a prescription for anti-infectives in the 30 days prior to admission compared to all other seniors in B.C. This research needs further exploration regarding other contributing factors, as well as analysis replication from other jurisdictions in order to confirm its validity. However, these findings may point to the need to attend to a higher than average fall risk among the elderly during the stages of an acute infection.

The drug category of anxiolytics, sedatives and hypnotics (of which 90 per cent are benzodiazepines) also emerged in the PharmaCare data as being more likely to be associated with a fall, either on its own or in combination with other drugs.

Findings from the preliminary analysis are also consistent with the research literature on higher fall risks for seniors who are prescribed psychotropic drugs such as paroxetine (Paxil), amitriptyline (Elavil), sertraline (Zoloft), loxapine (Loxitane); this literature shows that seniors taking these drugs were more likely to sustain a fall.

RISK FACTORS FOR FALLS

The existence of the following factors is associated with an increased risk of falling among the general population of seniors (Scott, 2000):

- **Biological factors:** Advanced age and female gender, chronic and acute illness, physical disability, muscle weakness, osteoporosis, stiffness, poor vision, poor mobility, poor balance, poor coordination, and cognitive impairments.
- **Behavioural risk factors:** Attempting to do activities or chores beyond one's physical ability, such as pruning trees, clearing snow, putting up Christmas lights or cleaning the top shelves of cupboards. Also, use of medication such as tranquilizers, alcohol abuse, wearing inappropriate footwear, inadequate diet and inadequate exercise.
- **Environmental risk factors:** Home hazards such as loose carpets, poorly lit stairs, cluttered floors, slippery showers, lack of grab bars; community hazards such as pavement cracks, tree roots, slippery footing, obstacles in walkways, for example, bike racks, flower boxes and garbage cans; institutional hazards such as poorly designed or maintained buildings, slippery floors, poor lighting or contrasts, and lack of handrails.
- **Social and economic risk factors:** Examples include inadequate income, low education, inadequate housing, and lack of social networks.

FOCUSING ON WHERE AND WHEN FALLS OCCUR

Understanding the interaction between the risk factors for falls and the settings where falls take place can help develop more effective strategies to reduce the incidence of falls. Existing evidence shows that falls tend to occur in the following locations:

- **Home/community:** The well elderly fall most often by taking risks such as climbing ladders or stools or engaging in vigorous activity; the frail elderly who are mobile but unsteady on their feet are most at risk and can fall while performing routine activities like dressing, bathing and toileting or walking along a familiar route.
- **Acute care hospitals:** Acute illness, extended bed rest, decreased mobility, delirium, unfamiliar surroundings and psychotropic medication use can predispose the elderly to falls in hospitals.
- **After discharge from hospital:** The first few weeks after discharge, when the elderly may be recuperating and still unsteady on their feet, are a high-risk time for falls.
- **Long-term care homes:** High levels of frailty among often chronically sick individuals, as well as cognitive impairment, inactivity, use of high-risk medications and reduced care giver/patient ratios can predispose some long-term care residents to falls.

EVIDENCE FOR PREVENTION

Fall prevention literature shows the following evidence based strategies are effective in reducing the incidence and prevalence of falls and fractures:

- **Exercise programs:** Examples include moderate weight lifting, Tai Chi and balance training.
- **Environmental modification:** Examples include removing risks from the home and the community; adding grab bars, stair rails and curb ramps; removing rugs, cords, obstacles and clutter; and painting pavement cracks and street obstacles in bright colours.
- **Education:** Examples include informing seniors and health providers about risks through information campaigns and health promotion activities.
- **Medication modification:** Helping seniors withdraw from benzodiazepines and other drugs; altering prescriptions to avoid interactions; taking calcium and vitamin D supplements or bone enhancing medication, especially for those with documented osteoporosis.
- **Clinical intervention:** Clinical assessments by nurses and doctors to identify seniors at high risk of falling, screening in emergency wards, doctors' offices and clinics for cognitive and physical fall risk factors - often combined with interventions to reduce behavioural or environmental risk factors.
- **Assistive devices/protective devices:** The correct use of walkers, canes, scooters and other devices designed to prevent falls; the use of hip protectors to cushion the hip from the impact of a fall.
- **Multifactorial intervention:** Combining a number of interventions such as any one or all of the following: exercise programs, environment and behavioural modtification, medication withdrawal, assistive device use and clinical assessment.
- **Prevention of fractures in the elderly:** Recent clinical reviews have emphasized the importance of maintaining and enhancing bone density and preventing osteoporosis with calcium and vitamin D and by taking bisphosphonate drugs. This is in addition to modifying other risk factors for osteoporosis – sedentary lifestyle, poor diet, smoking and alcohol misuse.

The strongest, evidence based, interventions (based on systematic reviews) have found the following results:

- The use of thorough, focused clinical assessments can help identify and then reduce the risk of falls, if followed up by targeted intervention, such as exercise, environmental modification, or hip protectors (multifactorial interventions).
- Exercise programs, particularly balance enhancing and muscle strengthening exercises, can be an effective prevention strategy. But, more research is needed to determine if one type of exercise is more effective than others and to identify which exercises are best for seniors with chronic health conditions or disabilities.
- Environmental modification can be effective, particularly if the senior has manual or financial help to modify their physical environment.
- There is insufficient evidence to conclude whether education alone is an effective intervention, but it does play a role as part of a multifactorial strategy that includes clinical assessment followed by targeted intervention. The benefits of staff education have not been well tested in community or long-term care.

MORE RESEARCH NEEDED

This report outlines a number of research gaps that should be addressed. Some of these research needs include the need to evaluate the effectiveness of different types of exercise among aging individuals with different abilities; the need to find ways to overcome the resistance to exercise among the elderly population; ways to help elderly individuals to withdraw from benzodiazepine medication; the need to find the most effective falls risk screening tools; and how to reduce risks of falls in long-term care homes, in acute care hospitals and after discharge.

RECOMMENDATIONS FROM THE PROVINCIAL HEALTH OFFICER

Currently, emergency response and acute medical care for falls receive most of the available health care funding and attention. Timely, effective and appropriate treatment will always be an essential component of good falls care in B.C. However, we must ensure that we are not simply treating the broken hip or the fractured wrist and neglecting to investigate and manage the cause of the fall and prevent subsequent falls. To further reduce the burden of injury from falls among the elderly, we must pay more attention and target more resources to the other points of intervention along this continuum, particularly safety promotion and primary prevention in order to prevent the falls and injuries from occurring in the first place.

In this report, the Provincial Health Officer presents a total of 31 recommendations regarding the actions various groups and individuals can take to reduce the number and consequences of falls in the province. The recommendations include input from peer reviews and from participants of five workshops attended by more than 300 people in the five B.C. Health Authorities.

Physicians can provide leadership and have a vital role in carrying out clinical assessments of fall risks. However, they should not be seen as the only leaders of fall prevention initiation. Physiotherapists, occupational therapists, nurses, and nurse practitioners often effectively initiate this role. The evidence points to multidisciplinary teams as being most effective. There is also an important role

for other health workers in the team, such as pharmacists, dieticians, optometrists, community health workers, podiatrists and emergency service workers. Acute care facilities, regional health authorities, and the municipal, provincial and federal governments all have a role to play in helping reduce the incidence of falls. Most importantly, prevention strategies must include the active involvement of seniors themselves in the design, implementation and evaluation of falls prevention programs, since seniors have "insider" knowledge and will be more receptive to initiatives if they have an active hand in their design.

Recommendations are made for physicians, pharmacists, managers of long-term care facilities, community health workers/home care nurses and other providers of services in seniors' homes, acute care hospitals, health researchers, regional health authorities and the Ministries of Health Services and Health Planning.

1. Introduction

The Provincial Health Officer is required by the *Health Act* to report independently to British Columbians on the health status of the population, on health issues and on the need for legislation, policies, or other actions that will improve the health of the population. In addition to producing an annual report, the Provincial Health Officer is given the discretion under the *Health Act* to issue reports from time to time on specific public health issues requiring attention.

Unintentional injury is a major public health problem in British Columbia and Canada. Across all age groups, injuries (unintentional and intentional combined) rank fourth among the leading causes of death in the country. For Aboriginal people injuries are the number one cause of death for all age groups. As the Canadian Public Health Association (CPHA) notes in a recent position paper, most injuries are the result of preventable factors rather than random "accidents". Injuries follow predictable patterns associated with age, gender, injury mechanism, social characteristics and geography (CPHA, 2002). These predictable patterns point to the potential for public health campaigns to target prevention, and control measures for specific groups, in order to reduce the toll of injuries.

PROVINCIAL HEALTH GOALS

The Provincial Health Officer plays a key role in promoting specific health goals for the province and in reporting on progress towards their achievement. Addressing the impact of falls comes under Health Goal 6 – the reduction of preventable illness, injuries, disabilities and premature deaths. This goal identifies achievable and measurable reductions in health problems that take a significant toll on the health of British Columbians, and for which effective prevention or early intervention strategies are available. Reducing falls in the elderly is an achievable goal.

Recognizing that unintentional injuries are an important public health problem, the deputy ministers of health across Canada have recommended that Health Canada, in consultation with public health officials and key stakeholders, coordinate the development of a national strategy for injury prevention. A priority that has emerged from that ongoing process is the prevention of falls in the elderly.

To many it may seem that falls, being so commonplace, warrant less public health concern than motor vehicle crashes, fires, drowning, poisonings and other unintentional injuries. However, preventing falls, particularly among aging British Columbians, is essential. The tragic and highly publicized fall by former Premier Mike Harcourt illustrated how devastating an impact a fall can have in causing serious disability. In fact, falls among all age groups in B.C. top all other causes of injury, both in terms of number of people affected and the personal and societal costs. Falls affect people of all ages but the greatest cost in both human and economic terms arises from falls among the elderly. This is a public health problem of huge proportions that will only intensify as our population ages. It is estimated that one in three people over the age of 65 will fall

at least once each year, a rate that increases to one in two people over the age of 80 (Tinetti et al., 1988; O'Loughlin et al., 1993). Almost half of those who fall experience a minor injury. Between 5 to 25 per cent sustain a serious injury, such as a fracture or a sprain (Alexander et al., 1992; Nevitt et al., 1991).

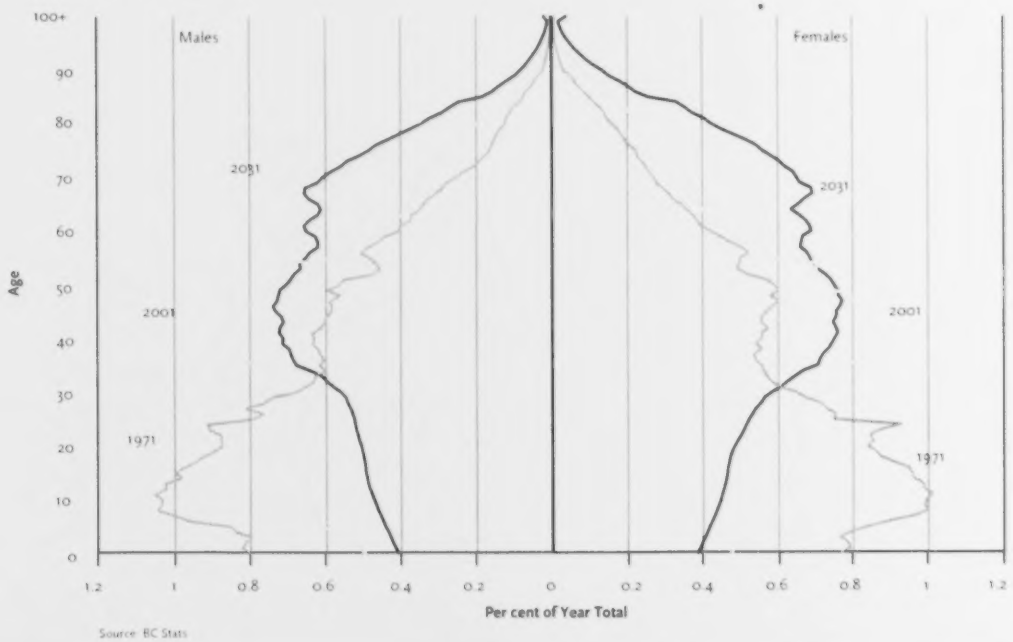
Falls are one of the greatest health risks to seniors. Injuries from falls account for 85 per cent of all injuries to the elderly and in 1998, cost British Columbia $180 million in direct health costs (Cloutier & Albert, 2001). And for the elderly themselves, it can be bewildering to find that a simple slip and fall – often while doing something they might have performed with ease even a few years earlier – can have such a potentially devastating impact on their health and lives.

There is great variability among the elderly population in B.C. However, this population can generally be divided into two health-related groups – the well elderly and the frail elderly. Falls and resulting injuries are typically seen as an indicator of frailty, with an attendant risk of morbidity and mortality. The frail elderly tend to fall while performing

AGING POPULATION = MORE FALLS

The fastest growing sector of the population is the "old-old", those 80 years of age and older. This sector has grown by 54 per cent in the last 10 years alone and will continue to gain another 43 per cent by 2011. By 2031, 23 per cent of the B.C. population will be over the age of 65. The number of falls and fall-related injuries is expected to increase proportionally with the aging population. By 2041, 88,000 hip fractures are expected to occur in Canada each year, up from 23,375 in 1993 (Papadimitropoulos et al., 1997). The personal and societal costs of falls will steadily increase with the aging population unless effective fall prevention initiatives are implemented.

FIGURE 1. **BRITISH COLUMBIA POPULATION PYRAMID, PER CENT DISTRIBUTION, JANUARY 2003**



Source: BC Stats

simple activities related to daily living, such as dressing or getting out of bed. This is in contrast to the well elderly, who are more likely to fall out of doors, and less likely to sustain a serious injury or to die from their falls. The well elderly are at greater risk of falling when they become temporarily frail, such as during episodes of acute illness or during convalescence following surgery.

The population pyramid in Figure 1 shows that the "bulge" in population between the period 1971 and 2001 will have moved into the older age group by 2031. The result is significant increases in the numbers of people over the age of 80 – the ones that experience falls.

INJURY PREVENTION AND EVALUATION CYCLE

Researchers at the B.C. Injury Research and Prevention Unit have refined a framework to describe the process of identifying and reducing injuries and evaluating the effectiveness of prevention strategies that can be applied to the problem of falls among the elderly (Raina et al., 2002). Called the Injury Prevention and Evaluation Cycle (IPEC), the framework uses research data and evidence as its foundation. Figure 2 shows the step-by-step cyclical process, that it links the burden of injury with risk factors and the conditions of injury and then brings in the evidence for the effectiveness and efficiency of interventions and prevention programs. With constant monitoring and reassessment of the prevention programs, any reductions of the burden of injury arising from prevention strategies can be registered and further refined.

Specific data elements are needed to accomplish each of the steps of Injury Prevention and Evaluation Cycle (IPEC) based on available theory and methods. Public health data such as hospitalization administration records are collected for specific purposes and the information available is limited to meet these needs. Furthermore the selection of data elements for collection can be influenced by:

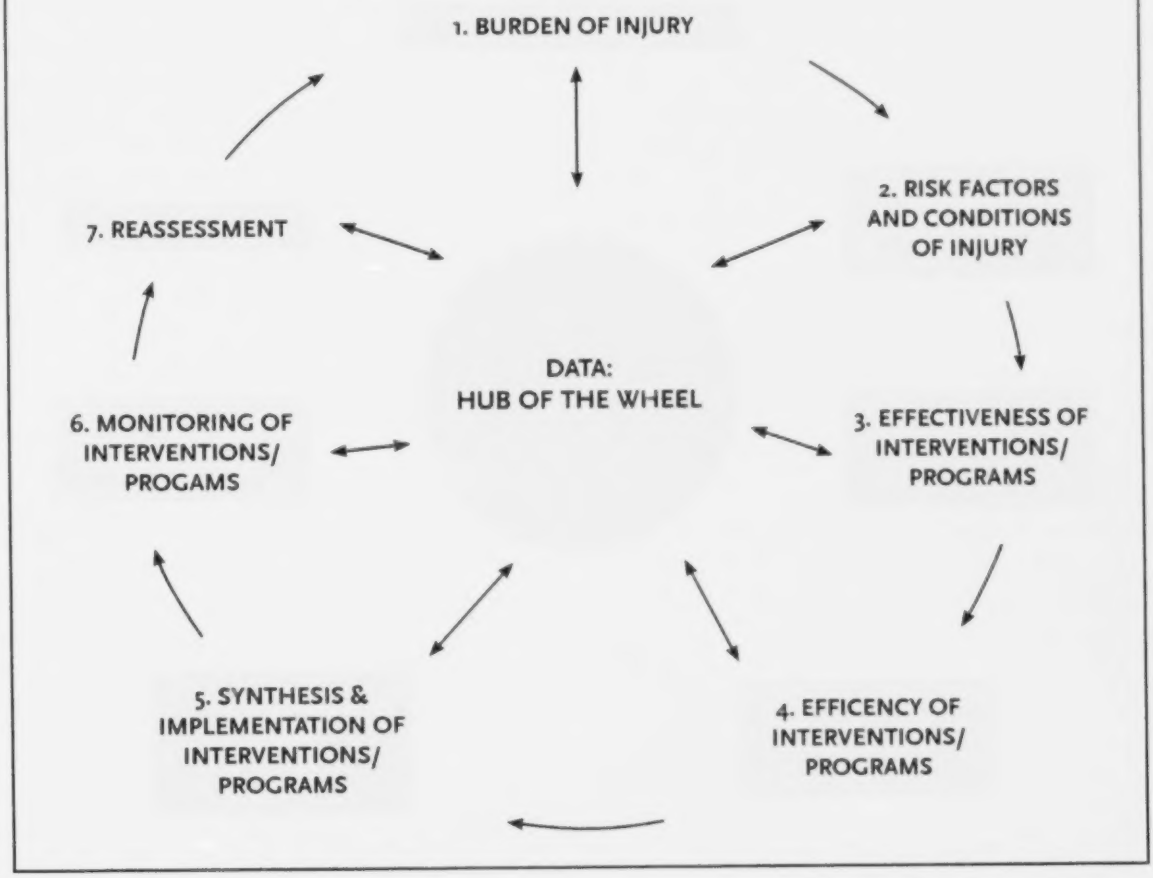
- political support
- ethical and privacy issues
- objectivity of the investigators
- finances, time and technical expertise

The ability to link different types of administrative databases increases the utility of the data collected by different organizations, providing the medical and cost details required for health care planning, resource allocations, and evaluations of specific programs. Targeted data collection of personal and injury event details can be used to determine risk factors and conditions of injury, and identify target populations at rish for specific injuries. This can be accomplished through the development of reliable and valid tools.

The simple fact is that falls are a preventable public health problem and we can do more to reduce the serious health impact of falls among the elderly citizens of British Columbia. Research in the last two decades has begun to show promising and proven interventions that can be implemented to reduce the incidence and severity of injuries due to falls.

For more detailed information about IPEC framework, visit BCIRPU's Web site www.injuryresearch.bc.ca. Elements of this framework are being used in this report to outline the evidence for the burden of injury from falls, the risk factors that research has identified as contributing to falls, and the evidence of effective prevention programs to reduce the incidence and severity of falls.

FIGURE 2: **THE INJURY PREVENTION AND EVALUATION CYCLE**


1. BURDEN OF INJURY
2. RISK FACTORS AND CONDITIONS OF INJURY
3. EFFECTIVENESS OF INTERVENTIONS/ PROGRAMS
4. EFFICENCY OF INTERVENTIONS/ PROGRAMS
5. SYNTHESIS & IMPLEMENTATION OF INTERVENTIONS/ PROGRAMS
6. MONITORING OF INTERVENTIONS/ PROGAMS
7. REASSESSMENT
DATA: HUB OF THE WHEEL

B.C. INJURY RESEARCH AND PREVENTION UNIT (BCIRPU)

Since 1998, BCIRPU, located at B.C. Children's & Women's Health Centre, has been conducting research, collecting data and evaluating programs to help reduce the impact of injuries in B.C. It coordinates research and prevention strategies, conducts and disseminates relevant and timely multidisciplinary, evidence-based injury research, and conducts ongoing injury surveillance across B.C., including the rate of falls. BCIRPU has an advisor dedicated to falls in the elderly, Dr. Victoria Scott, who works with health authorities on projects to reduce falls among all age groups. BCIRPU has released its own in-depth report: *Unintentional Fall-Related Injuries and Deaths Among Seniors in British Columbia: Trends, Patterns and Future Projections 1987-2012.* The document is available on the BCIRPU Web site: www.injuryresearch.bc.ca

BCIRPU is also coordinating the Emergency Department Injury Surveillance System (EDISS), a project in which emergency departments in ten hospitals around the province are collecting information about causes, types and numbers of injuries. The data collected by EDISS will be analyzed to better understand the cause and effect of injuries in B.C. and to help design and evaluate injury prevention programs in the regions. The most recent EDISS data for falls in B.C. is presented at the end of Section 2 of this report.

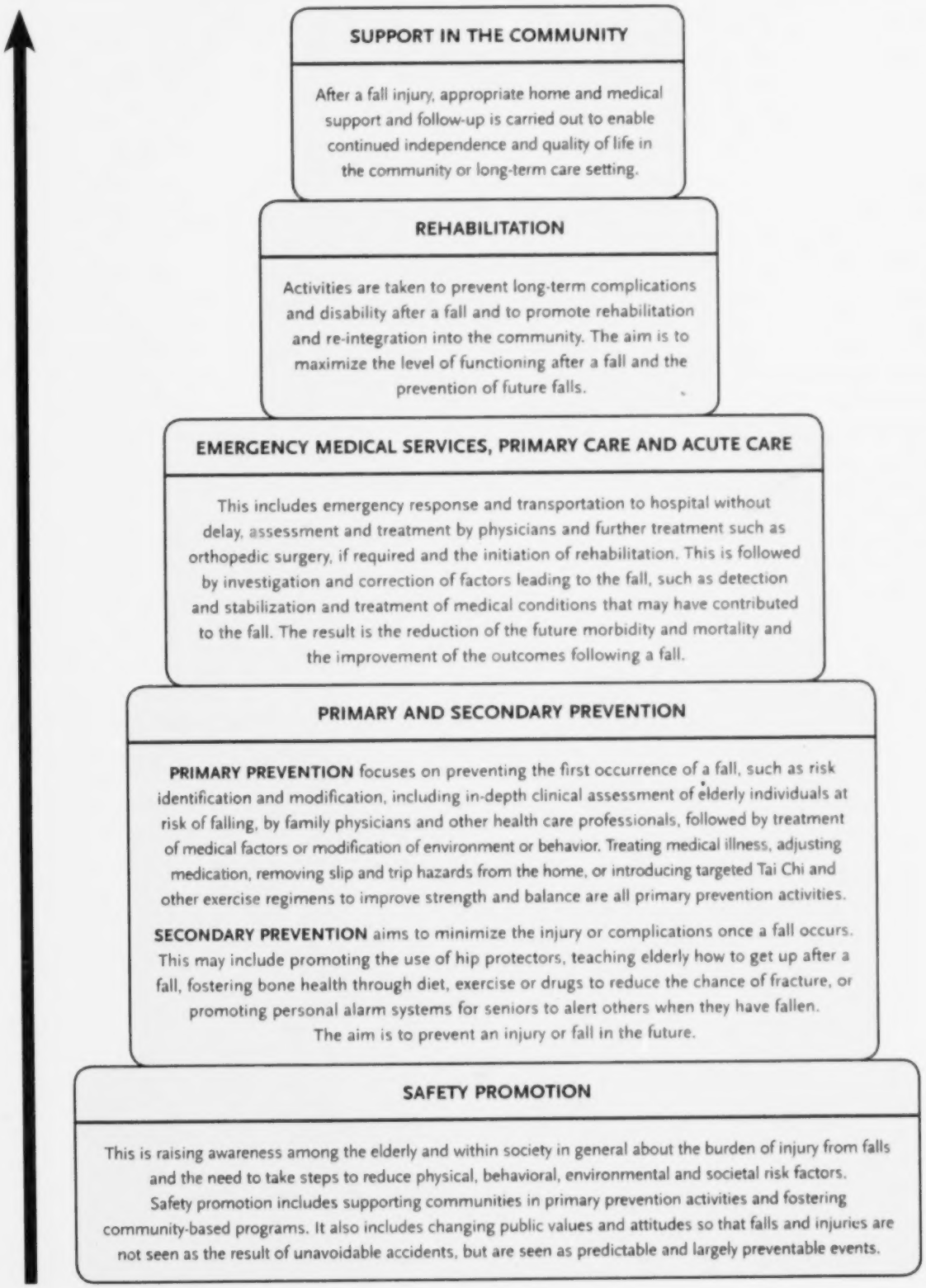
The BCIRPU also has an extensive repository of information on validated assessment tools for falls risks as well as other injury groups. This repository is available through its Web site at www.injuryresearch.bc.ca

INJURY PREVENTION MODEL – POINTS OF INTERVENTION CONTINUUM

A population health promotion approach to falls takes into account the full spectrum of the factors and their interactions that are known to influence health and the outcome of the injuries. The following diagram (adapted from Peck et al., 2002) identifies the points of intervention along a continuum of health service activities that can reduce incidence and severity of falls among the elderly and improve the outcomes for those who experience falls.

Currently, emergency response and acute medical care for falls receive the most of the available health care funding and attention. While timely, appropriate and effective emergency and acute care are essential elements of the continuum of care, we must ensure, that we are not simply treating the broken hip or the fractured wrist and neglecting to investigate and manage the cause of the fall or to prevent subsequent falls and injuries. To further reduce the burden of injury of falls among the elderly, we must pay more attention and target more resources to the other points of intervention along this continuum, particularly safety promotion, primary prevention and secondary prevention, to prevent the falls and injuries from occurring in the first place.

FALLS INJURY PREVENTION MODEL – POINTS OF INTERVENTION CONTINUUM


SUPPORT IN THE COMMUNITY
After a fall injury, appropriate home and medical support and follow-up is carried out to enable continued independence and quality of life in the community or long-term care setting.
REHABILITATION
Activities are taken to prevent long-term complications and disability after a fall and to promote rehabilitation and re-integration into the community. The aim is to maximize the level of functioning after a fall and the prevention of future falls.
EMERGENCY MEDICAL SERVICES, PRIMARY CARE AND ACUTE CARE
This includes emergency response and transportation to hospital without delay, assessment and treatment by physicians and further treatment such as orthopedic surgery, if required and the initiation of rehabilitation. This is followed by investigation and correction of factors leading to the fall, such as detection and stabilization and treatment of medical conditions that may have contributed to the fall. The result is the reduction of the future morbidity and mortality and the improvement of the outcomes following a fall.
PRIMARY AND SECONDARY PREVENTION
PRIMARY PREVENTION focuses on preventing the first occurrence of a fall, such as risk identification and modification, including in-depth clinical assessment of elderly individuals at risk of falling, by family physicians and other health care professionals, followed by treatment of medical factors or modification of environment or behavior. Treating medical illness, adjusting medication, removing slip and trip hazards from the home, or introducing targeted Tai Chi and other exercise regimens to improve strength and balance are all primary prevention activities.
SECONDARY PREVENTION aims to minimize the injury or complications once a fall occurs. This may include promoting the use of hip protectors, teaching elderly how to get up after a fall, fostering bone health through diet, exercise or drugs to reduce the chance of fracture, or promoting personal alarm systems for seniors to alert others when they have fallen. The aim is to prevent an injury or fall in the future.
SAFETY PROMOTION
This is raising awareness among the elderly and within society in general about the burden of injury from falls and the need to take steps to reduce physical, behavioral, environmental and societal risk factors. Safety promotion includes supporting communities in primary prevention activities and fostering community-based programs. It also includes changing public values and attitudes so that falls and injuries are not seen as the result of unavoidable accidents, but are seen as predictable and largely preventable events.

2. Burden of Injury from Falls

It can happen in an instant: reaching on a wobbly stool for something located on a high shelf, tripping over uneven pavement, slipping on a rug or a patch of ice, or getting up from a bed, a bath, a toilet or a chair. It can happen in a person's home, in the community, while a patient is in an acute care hospital, or as a resident in a long-term care home. There are numerous ways an elderly person can suddenly trip or lose their balance, resulting in an injury.

Based on a number of studies, it is estimated that one in three seniors will likely have a fall each year (Tinetti et al., 1989; O'Loughlin et al., 1993). In B.C., this means that an estimated 147,000 British Columbians over age 65 are likely to fall this year. Many of these falls will not result in injuries. However, a fall can cause a loss in confidence, increased fear and curtailment of activities, which can lead to a decline in health or be a precursor to a more serious fall to come. If the fall results in a serious injury, this can lead to long-term disability or even death. With or without injuries, a fall can precipitate a loss of independence and perhaps the need to enter a long-term care facility.

The personal, medical and economic toll of falls in Canada is great:

- Falls are the most common cause of injury for elderly people (Raina et al., 1997).
- Falls accounted for 57 per cent of deaths due to injuries among females age 65 and older (ibid).
- Falls accounted for 36 per cent of deaths due to injuries among males (ibid).
- Falls are responsible for 70 per cent of injury related days of hospital care for elderly people (ibid).
- Falls cause more than 90 per cent of all hip fractures in the elderly and 20 per cent die within a year of the fracture. Almost half of people who sustain a hip fracture never recover full functioning (Zuckerman, 1996).
- Falls are directly accountable for 40 per cent of all elderly admissions to nursing homes or long-term care facilities (Rawsky, 1998).
- Falls can cause long-term disability, chronic pain, and lingering fear of falling again (Grisso et al., 1990; Tinetti et al., 1994). The aftermath of pain or fear from a fall can lead seniors to restrict their activities, which in turn can increase the risk of falling because of increased muscle weakness, stiffness or loss of coordination or balance.
- Fall-related injures in Canada among those 65 and older have been estimated to cost the economy $2.8 billion a year (Asche, Gallagher & Coyte, 2000). This amount includes the direct costs of hospitalization, medical care and professional services, and indirect costs such as lost productivity. It does not include the cost of medications, research, negligence claims, or the work of non-professional caregivers.

MAGNITUDE OF THE ISSUE IN BRITISH COLUMBIA

Falls among the elderly account for the largest proportion of all injury related deaths and hospitalizations in British Columbia.

A study of the economic burden of unintentional injury in B.C., prepared on behalf of the B.C. Injury Research and Prevention Unit (Cloutier & Albert, 2001)

TRAUMA EVEN WITHOUT INJURY

A fall can cause psychological damage even if the senior is not physically injured. Fall researchers describe a "fear of falling cycle" in which after a fall seniors become so afraid of falling again they limit their activities. This in turn decreases their fitness, mobility and balance and leads to decreased social interactions, reduced satisfaction with life and increased depression. This fear cycle then increases the risk of another fall.

(Tinetti et al., 1988; Nevitt et al., 1989; Arfken et al., 1994)

found falls among the elderly to be among the leading preventable injuries. The study examined both direct costs and indirect costs. Direct costs are health care costs including hospitalizations, medications, health provider consultations in treatment, and rehabilitation. Indirect costs are societal productivity losses arising from the individual's inability to perform his or her usual activities due to the injury.

According to Cloutier & Albert, in 1998, preventable injuries cost the people of B.C. $2.1 billion, of which falls for all ages accounted for $728 million or 36 per cent of total direct and indirect costs. Their study found that of the 424,000 injuries in 1998, the highest direct cost came from falls among all age groups, totaling almost $437 million or 51 per cent of direct costs. For instance, the direct cost of injuries from falls was more than three times greater than injuries from motor vehicles, which had the second highest direct costs at $131 million, or 15 per cent of direct costs.

Cloutier & Albert noted that caring for injured elderly people cost $211 million, of which $180 million was attributable to falls. Falls among elderly women account for 73 per cent of the costs, or $131 million. A single hip fracture adds between $24,400 to $28,000 in direct health costs to the system.

Cloutier & Albert noted that setting a target of a 20 per cent reduction in hospitalization rates for falls among the elderly, for example, would lead to 1,400 fewer hospital stays and 350 fewer elderly people disabled, based on current rates. Preventing the elderly from falling could amount to almost $25 million a year in total costs saved to the B.C. economy.

NEW FALLS DATA IN B.C.

The Population Health Surveillance and Epidemiology Branch of B.C. Ministry of Health Planning has compiled the most recent data about the impact of falls in B.C. that result in hospitalization or death. These data have been collected from B.C. Vital Statistics Agency, and from the hospital Discharge Abstract Database from the Canadian Institute for Health Information and from B.C.'s PharmaCare program.

HOSPITAL SEPARATIONS

A separation from a health care facility occurs anytime a patient leaves because of death, discharge, or transfer and is therefore the most commonly used measure of the utilization of hospital services. The information is gathered at the time the patient leaves the hospital, rather than upon admission. The terms "hospitalization", "hospital cases", "discharge", and "stay" are also sometimes used.

B.C. data on the impact of falls among seniors – death rates, number of hospital separations and days spent in hospital – provide convincing evidence of the need to focus prevention efforts on reducing the number of falls and injuries. According to this new research, in 2001 alone, 771 people over the age of 65 died either directly or indirectly from a fall.

SENIORS' DEATHS FROM FALLS IN B.C.

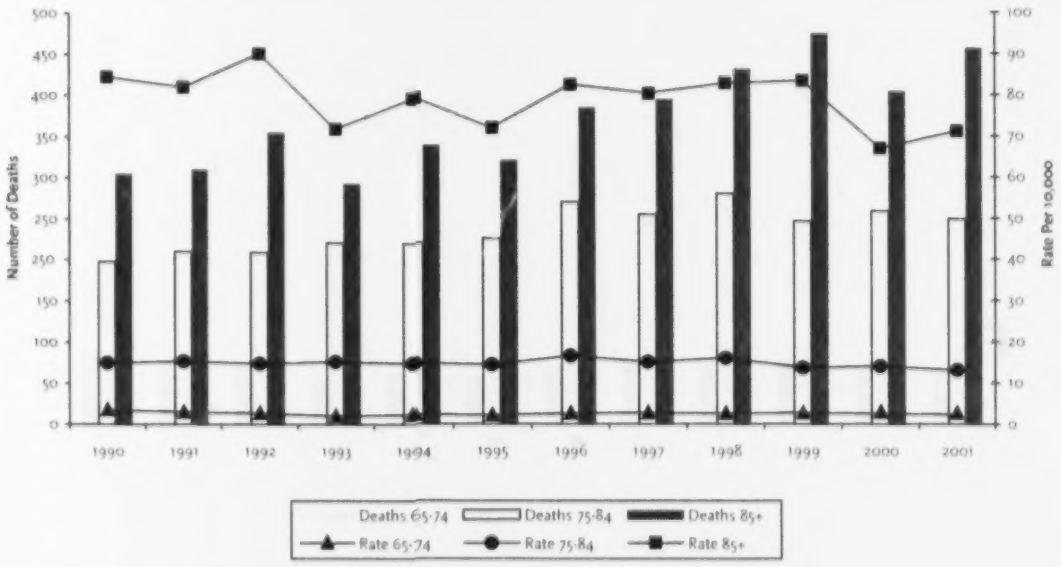
As Figure 3 shows, the older you are, the more likely you are to die from a fall. The highest rate of death, either directly or indirectly, is in the population over age 85. Over the last decade, there has been no improvement in the rate of deaths from falls in any of the three age groups over age 65; the death rates have remained consistent.

The absolute number of people dying, either directly or indirectly, due to falls has increased, as a function of the increasing number of people over 65 in British Columbia. The largest increase in absolute numbers is among those age 85 years and older. In 2001, approximately 450 people age 85 years and older died either indirectly or directly from falls, compared to about 300 in 1990.

As Figure 4 illustrates, indirect death rates (where a fall contributed to the cause of death) exceed direct deaths in all age groups, although the difference is greatest for those age 85 years and older.

Figure 5 shows that in absolute numbers, more women than men over the age of 65 died either directly or indirectly from falls, most likely because women outnumber men in this age group. However, when considering death rates, the data show that at the beginning of the decade the

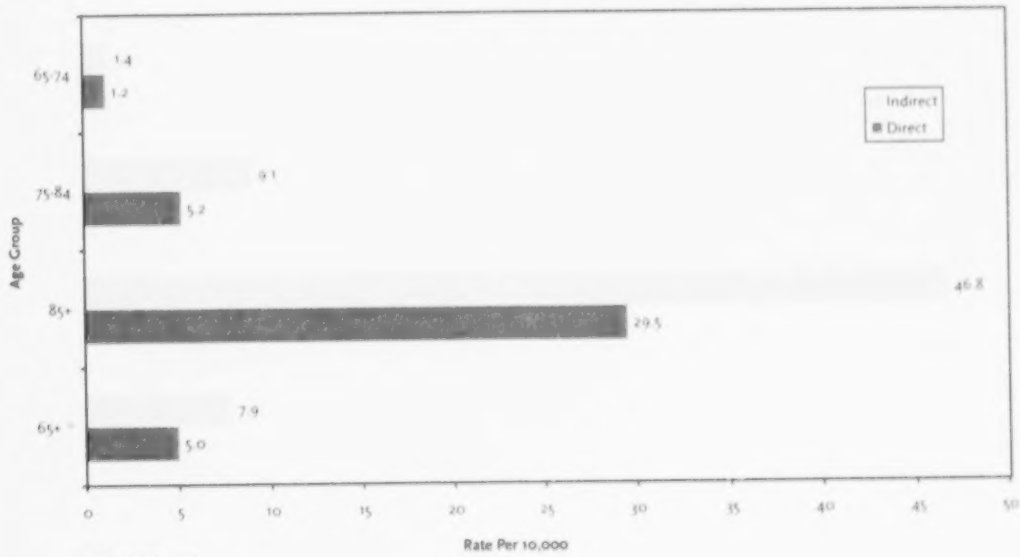
FIGURE 3. **DEATHS DIRECTLY AND INDIRECTLY DUE TO FALLS IN SENIORS, 1990 TO 2001**



Notes:
Direct cause of death = the underlying cause of death or what the person died of
Indirect cause of death = contributing, associated, or antecedent causes to the underlying cause of death
Falls = ICD-9 E880 - E888, ICD-10 W00 - W19.

Source: B.C. Vital Statistics Agency

FIGURE 4. DEATH RATES DUE TO FALLS IN SENIORS, BY AGE GROUP, B.C. 1997-2001

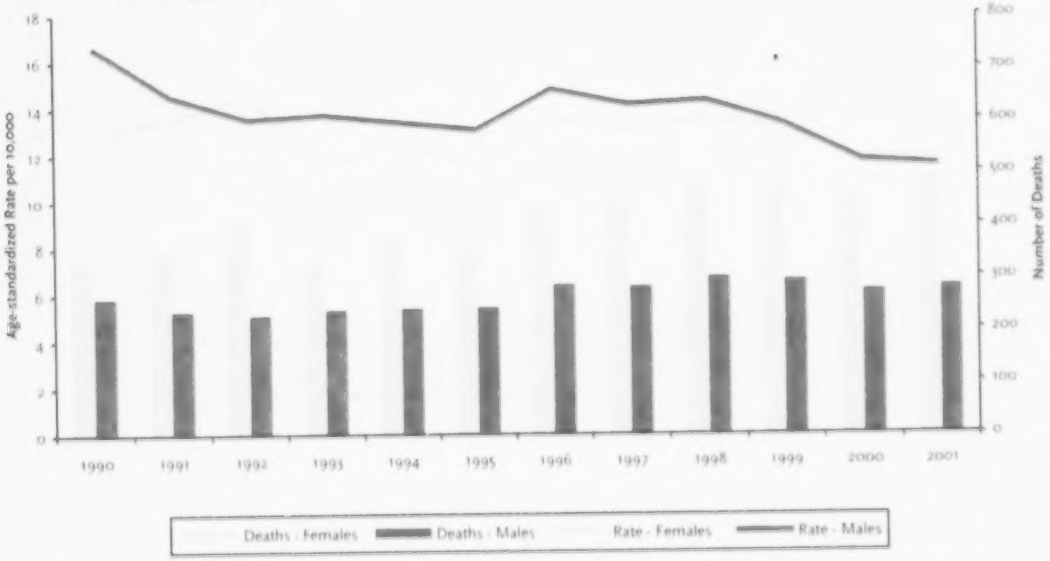


* Age-Standardized

Notes:
Direct cause of death = the underlying cause of death or what the person died of.
Indirect cause of death = contributing, associated, or antecedent causes to the underlying cause of death.
Falls = ICD-9 E880 - E888, ICD-10 W00 - W19.

Source: B.C. Vital Statistics Agency

FIGURE 5. DIRECT AND INDIRECT DEATHS DUE TO FALLS IN SENIORS, BY GENDER, B.C., 1990 TO 2001



Notes:
Direct cause of death = the underlying cause of death or what the person died of.
Indirect cause of death = contributing, associated, or antecedent causes to the underlying cause of death.
Falls = ICD-9 E880 - E888, ICD-10 W00 - W19.

Source: B.C. Vital Statistics Agency

INDIRECT DEATHS

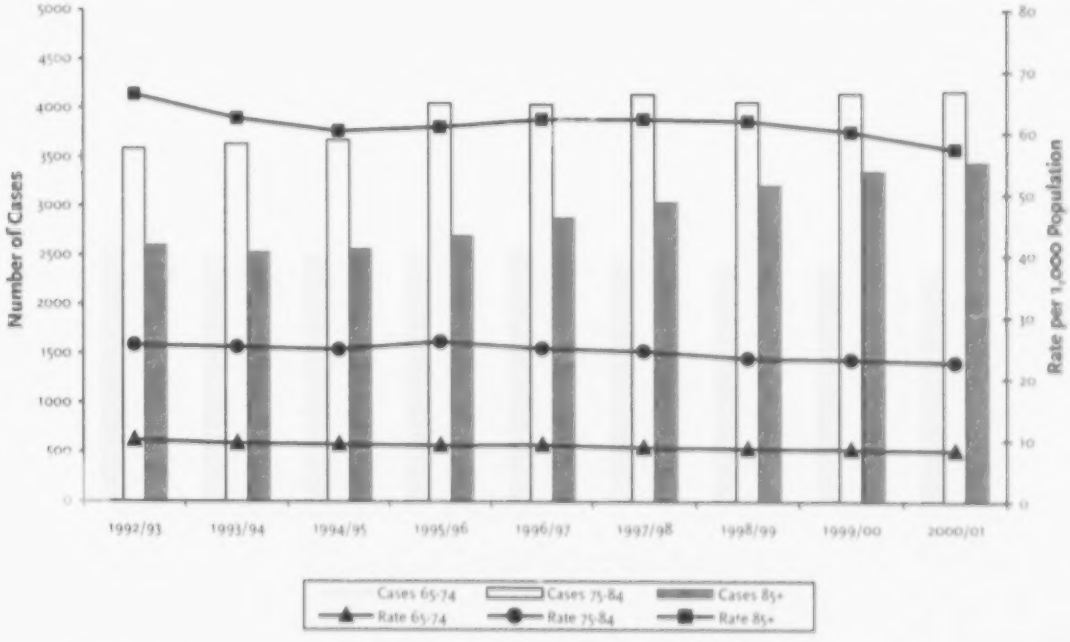
An indirect death from a fall occurs when the fall itself is not deadly, but the injuries that are sustained undermine the individual's health so much that other diseases and illnesses prove fatal. Pneumonia and infections are often the causes of indirect deaths after a fall.

mortality rate for males was higher than for females. For reasons that are not clear, the death rate for males has declined significantly (p=0.010) over the last 10 years. Currently, the male and female indirect and direct mortality rate for falls is similar.

FALL-RELATED HOSPITAL UTILIZATION

Figure 6 shows that falls were either the primary cause or a secondary contributing cause for about 8,700 hospital separations (cases) in 1992/93 in all three age groups of seniors. Due to the increasing numbers of seniors in the B.C. population, the absolute number of hospitalizations for falls for all age groups increased to 10,000 by 2000/01. The (age-standardized) rate of hospital cases per 1,000 population over the age of 65, however, showed a small but statistically significant (p= < 0.001) decline over the decade. This decline of hospital separations was seen in all three age groups of those over age 65. It is unclear whether this decline indicates fewer fall-related injuries or an indication of a change in hospital management, such as the increased tendency wherever

FIGURE 6. **FALLS IN SENIORS, HOSPITAL CASES AND RATES, B.C., 1992/93 TO 2000/01**



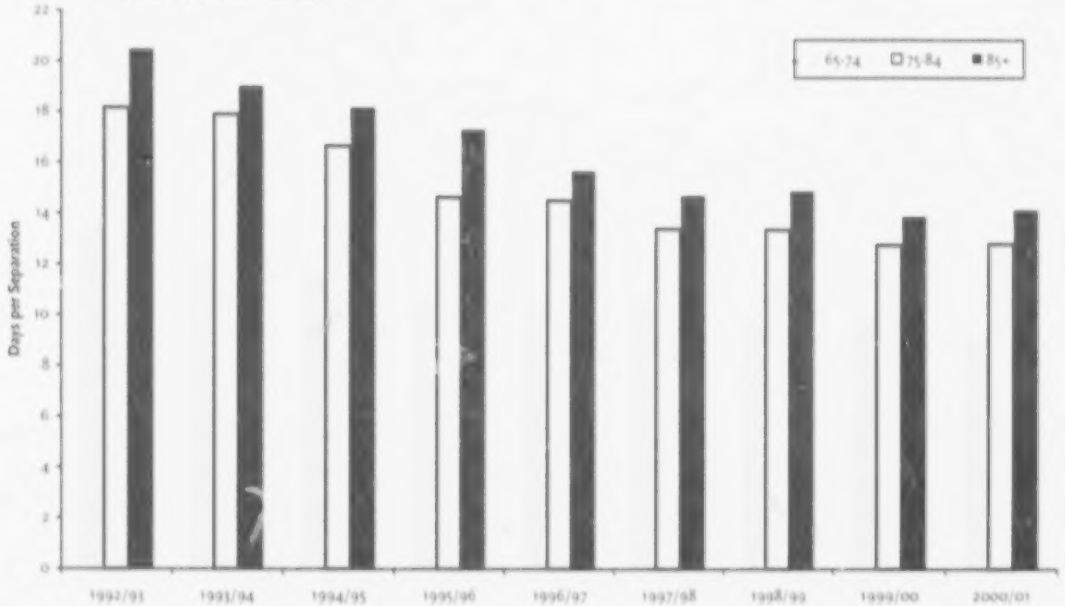
Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database

possible to treat and release elderly people in the emergency department and to support them at home. Alternatively, these changes may reflect the combined effect of improved fall prevention strategies in B.C. combined with an increase in outpatient services and a decrease in hospital beds per capita. For Figure 6 and the following figures where data were extracted from the Discharge Abstract Database, falls were either the primary or were included as one of the secondary reasons for a hospital stay.

Figure 7 illustrates that the older the person, the longer they are likely to remain in hospital after sustaining a fall-related injury. However, the length of stay is now declining significantly. In 1992/93, the average length of hospital stay for a senior who had fallen ranged from about 13 days for those aged 65 to 74 to a high of 21 days for those over age 85. Figure 7 shows that the average length of stay for all age groups declined significantly ($p=< 0.001$) over the last decade so that in 2000/01 those 65 to 74 years old are likely to spend about nine days in hospital and those over the age of 85 are likely to spend about 14 days in hospital. The decline in lengths of hospital stays for falls is probably more a function of a trend in hospital management – which is encouraging shorter hospital stays for all causes – than a reduction in the severity of injury from falls over the last decade.

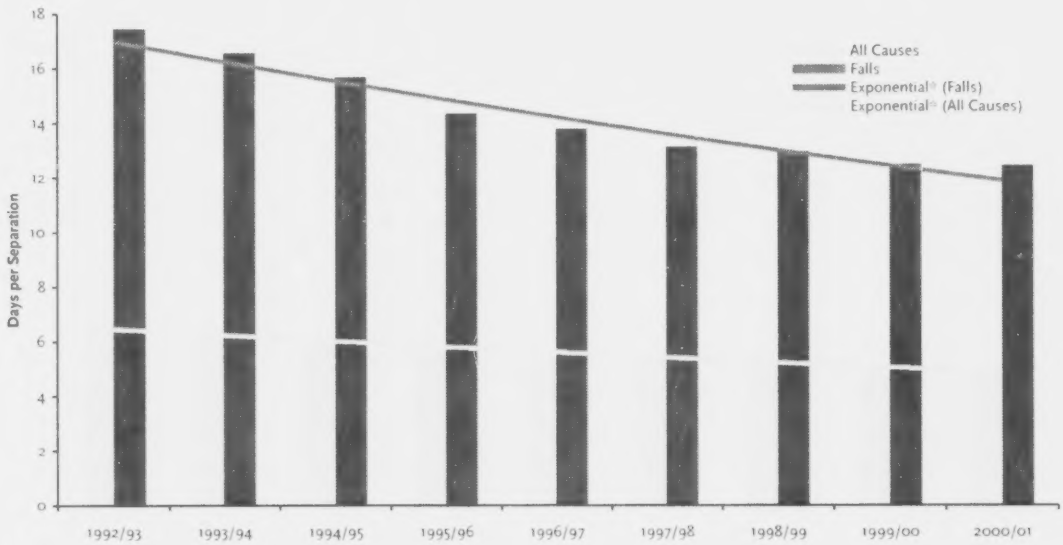
Figure 8 confirms that the length of hospital stays has declined over the last decade for all causes, but length of stays for falls has declined at a slightly greater rate. It is not clear why, but it could be from the phenomenon that the longer an older person stays in hospital after an injury the less likely they are able to return to independent life in the community. There has been concerted effort to release patients as soon as possible.

FIGURE 7. **FALLS IN SENIORS, AVERAGE LENGTH OF STAY, BY AGE GROUP, B.C., 1992/93 TO 2000/01**



Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database

FIGURE 8. **AVERAGE LENGTH OF STAY PER CASE, ALL CAUSES AND FALLS-ASSOCIATED HOSPITAL SEPARATIONS FOR SENIORS, B.C. 1992/93- 2000/01**



* Exponential growth occurs when a quantity is increasing at a rate proportional to the current amount. Exponential growth is unstable since nothing can grow exponentially forever without running into some kind of limit. Note that a positive time constant corresponds to exponential decay, while a negative time constant corresponds to exponential growth.

Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database.

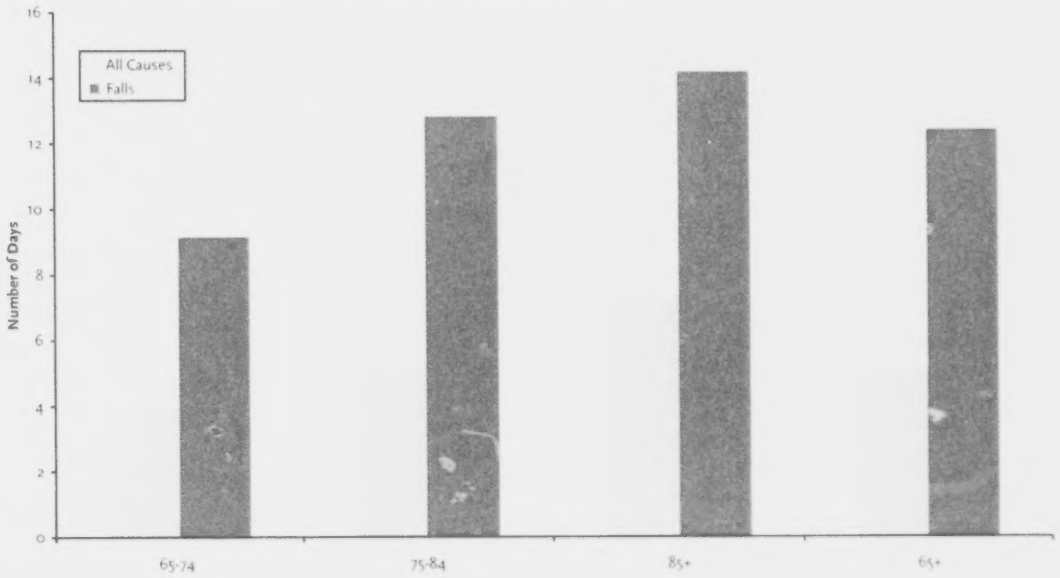
However, despite the trend for shorter hospital stay, Figure 9 shows that the average length of hospital stay for people who have fallen is still more than twice as long in each age group for falls than for all causes of hospitalization for people over the age of 65.

As Figure 10 shows, over the last decade, falls have remained a consistent cause of hospitalization for seniors in relation to all causes of hospitalization. For those 85 and older, falls comprise 11 per cent of all hospitalizations. For those between age 65 and 84, falls account for between 2.5 per cent to 4.5 per cent of all hospitalizations.

Although falls account for up to 11 per cent of all hospital separations for those 85 and older, Figure 11 shows that over the last decade they accounted for an average 24 per cent of all hospital days a senior would spend in a hospital bed compared with all causes. As noted, the number of days spent in hospital for falls has declined during the last decade. For days related to falls, this decline is significant ($p=<0.001$) in relation to all causes.

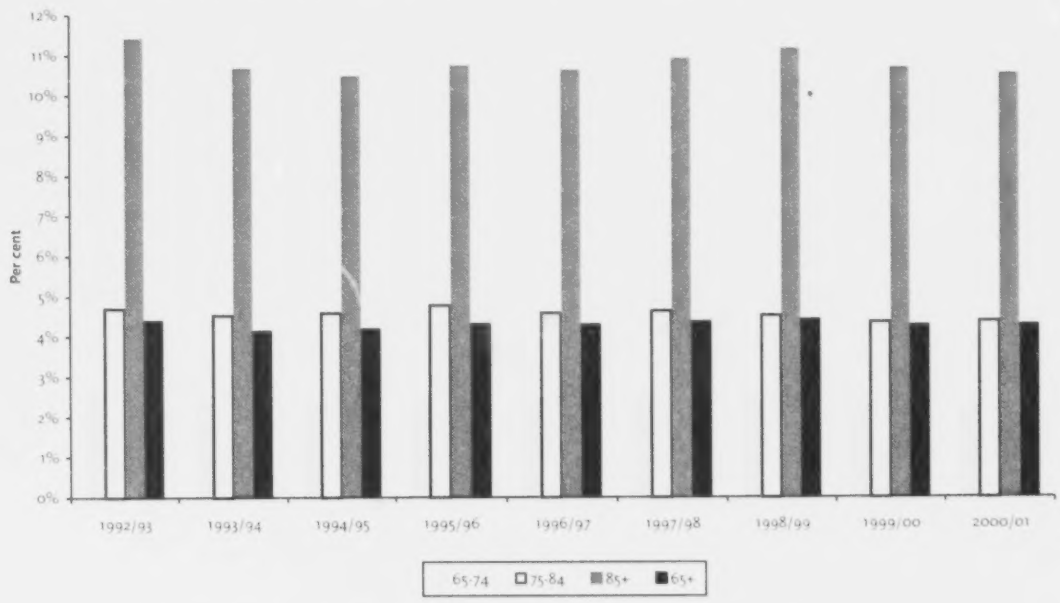
As is shown in Figure 12, over the past nine years, more than 40,000 seniors in B.C. have broken their hip or femur, accounting for 37.9 per cent of all fall-related injuries among seniors treated in hospital. Fractures to other locations, including other fractures to the lower limb, the upper limb (arm, wrist, hand or shoulder) along with fractures of the spine, trunk or skull, account for 39.2 per cent of fall-related hospitalizations. Other injuries and complications of trauma from falls account for another 12.5 per cent.

FIGURE 9. **AVERAGE LENGTH OF STAY PER CASE, ALL CAUSES AND FALLS-ASSOCIATED HOSPITAL SEPARATIONS FOR SENIORS, 2000/01**



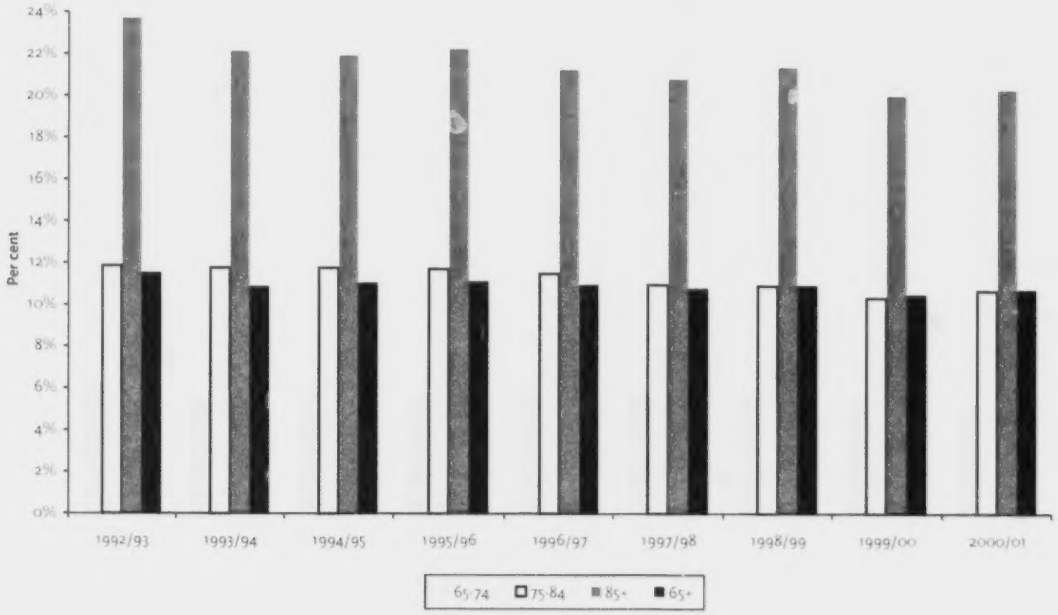
Source: Acute/rehabilitation separations for 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database

FIGURE 10. **HOSPITAL CASES FOR FALLS AS A PER CENT OF HOSPITAL CASES FOR ALL CAUSES, BY AGE GROUP, B.C., 1992/93 TO 2000/01**



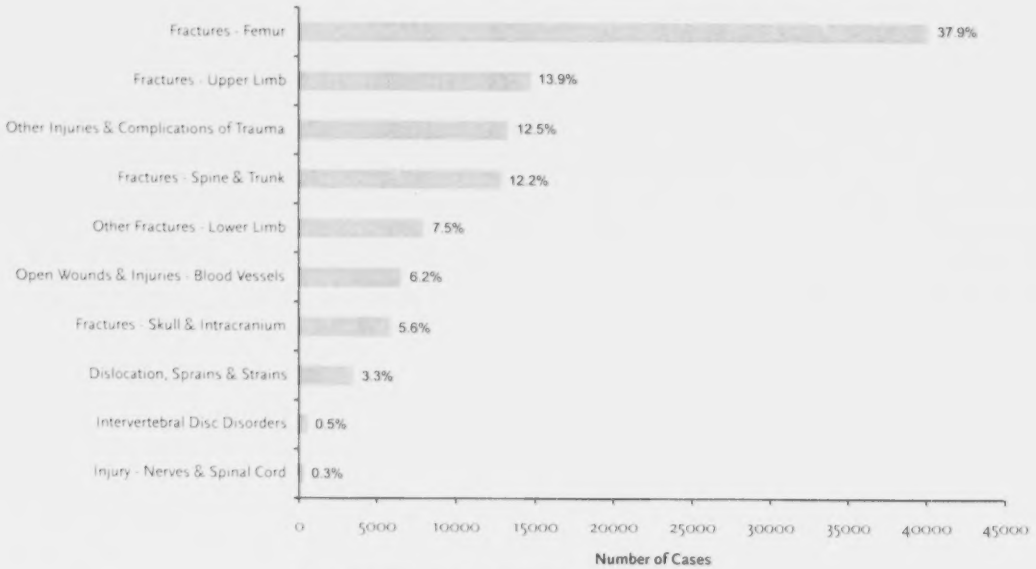
Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database

FIGURE 11. **HOSPITAL DAYS FOR FALLS AS A PER CENT OF HOSPITAL DAYS FOR ALL CAUSES, BY AGE GROUP, B.C., 1992/93 TO 2000/01**



Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database.

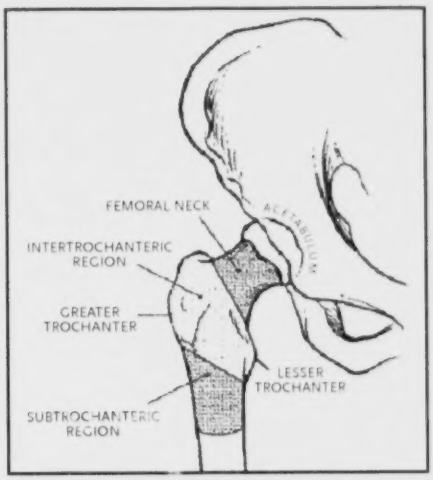
FIGURE 12. **NUMBER AND PER CENT OF HOSPITAL CASES ASSOCIATED WITH FALLS BY INJURY TYPE, B.C., 1992/93 TO 2000/01**



* Injury type as classified in MCC 25 Significant Trauma.

Source: Acute/rehabilitation separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database.

SNAPSHOT: HIP FRACTURES IN B.C.



Each year in B.C., more than 3,100 seniors break their hips, about two thirds of them are women. Risk factors for falling, combined with weakened bones from age and osteoporosis, contribute to the high rate of hip fractures in the elderly. Women taller than 5'8" are twice as likely to fall and break a hip than women smaller than 5'2". Hip fractures are generally either a femoral neck fracture (45 per cent) or an intertrochanteric fracture (45 per cent). About 10 per cent are subtrochanteric fractures (Zuckerman, 1996).

HIP FRACTURE FACTS:

- 38 per cent of hospital admissions for fall injuries are for hip fractures
- 90 per cent of hip fractures are due to a fall
- 90 per cent of hip fractures occur among those aged 70 or older
- 50 per cent of post hip fracture patients require permanent use of a cane, walker or other mobility aid for walking
- 30 per cent of hip fractures occur among 5 per cent of seniors living in institutional/residential settings
- 20 per cent of seniors die within a year of a hip fracture (Zuckerman, 1996)

TREATMENT: The goal of treatment is to return the patient to their level of functioning before the fracture. The majority of elderly people who break their hips are treated by a surgical hip replacement that replaces the joint with a prosthesis. Some interotrochanteric and subtrochanteric hip fractures can be fused by an internal fixation with one or more sliding metal screws.

REHABILITATION: Early mobilization of the joint and patient is essential to avoid complications and achieve good results, including moving from bed to a chair the first day after surgery and progressing to walking within three or four days. Physical therapy, featuring gentle exercise and range of motion activities, are essential to regain functional recovery. Exercises, stretching and range of motion activities must usually be continued for life. During rehabilitation it is important to investigate for the presence of – and the potential to treat – osteoporosis.

REGIONAL VARIATIONS IN FALLS DATA

The Population Health Surveillance and Epidemiology Branch of B.C. Ministry of Health Planning has compiled the most recent data about the impact of falls in B.C. by the various health regions. The data has been collected for each of the five health authorities from B.C. Vital Statistics Agency and from the hospital Discharge Abstract Database of the Canadian Institute for Health Information. The data, some of which are presented here, show interesting differences between death rates, number of hospital cases and number of hospital days in each region. This is preliminary data and presented here for the interest and attention of health care providers in each of the individual health authorities.

It is not clear why some of these differences exist. Participants at workshops with Health Authorities suggested that the following may contribute to differences – presence of active discharge planning programs, presence of day care surgery, living in rural or remote regions with greater travel distances, less access to home care services, climatic conditions, less mobility of seniors in winter months and referral of more serious injuries to urban centers. The data will help individual health authorities to better understand the nature and impact of falls in their region and to design and evaluate their falls prevention programs. Additional regional charts can be found in Appendix C.

The provincial death rate for falls is about 5 deaths per 10,000 population for ages 65 years and over, as illustrated in Figure 13. For females, three of the five health regions in B.C. – The Interior, Vancouver Island and Northern Health Authorities' – had rates that were significantly higher than the provincial average. The Fraser and Vancouver Coastal Health Authorities' death rates were significantly lower than the provincial average.

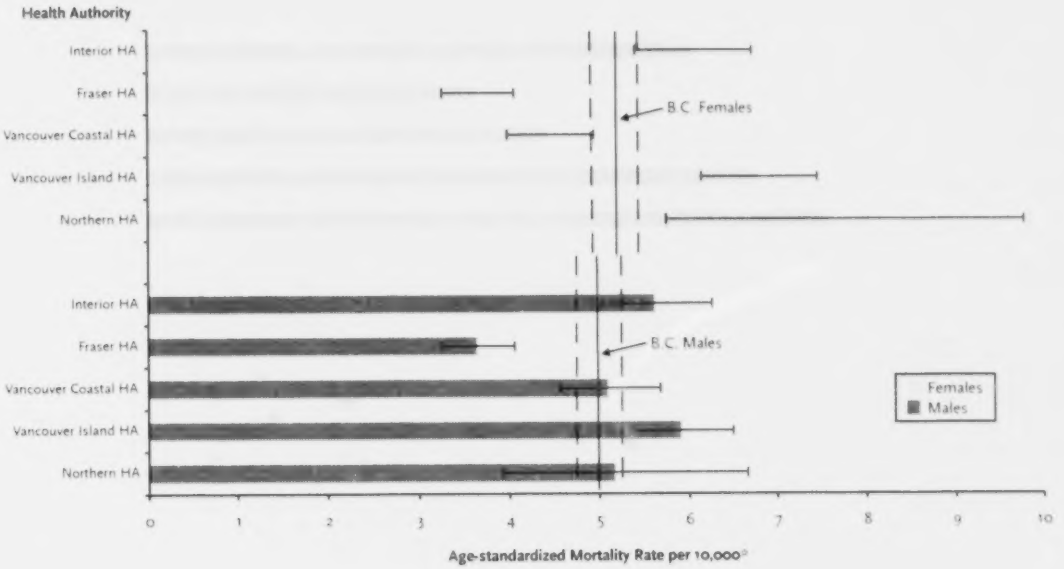
For men, two health authorities – the Interior and Vancouver Island – had death rates that were above the provincial average. It is not clear why there are regional differences in death rates. However, given that the rates are lowest in the most densely populated southern regions – contributing factors (as suggested at the regional workshops) may include access to health services, climate, terrain and lifestyle.

Figure 14 shows hospital separations for fall-related injuries were higher than the provincial average for all health service delivery areas in the Northern Health Authority and were higher for all but one of the health service delivery areas in the Interior Health Authority. Hospital separations were lower than the provincial average for all health service delivery areas within the Vancouver Coastal Health Authority and were lower for all but one health service delivery area within both the Fraser Health Authority and Vancouver Island Health Authority. As with the pattern above for fall-related deaths, the lowest rates are found in the areas of higher population density, in the southern regions of the province.

While hospital separations (cases) measures the number of people admitted and subsequently discharged, transferred or deceased following a fall-related injury, hospital days represent the average length of time patients spent in hospital in which a fall contributed to the hospital stay.

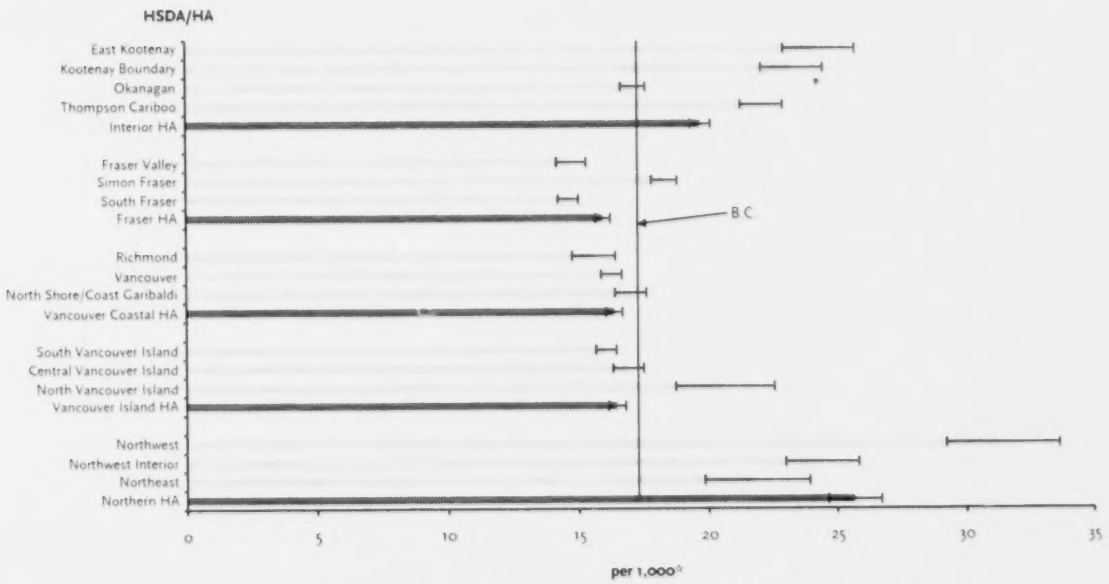
In contrast to the Figure 14 graph in which Vancouver Coastal Health Authority had among the lowest number of hospital cases for falls in the province, Figure 15 shows that the number of hospital days used for falls were higher than the provincial average and second only to the

FIGURE 13. **MORTALITY RATES, DEATHS DIRECTLY DUE TO FALLS IN SENIORS AGED 65+ YEARS, MALES AND FEMALES, BY HEALTH AUTHORITY, B.C., 1997-2001.**



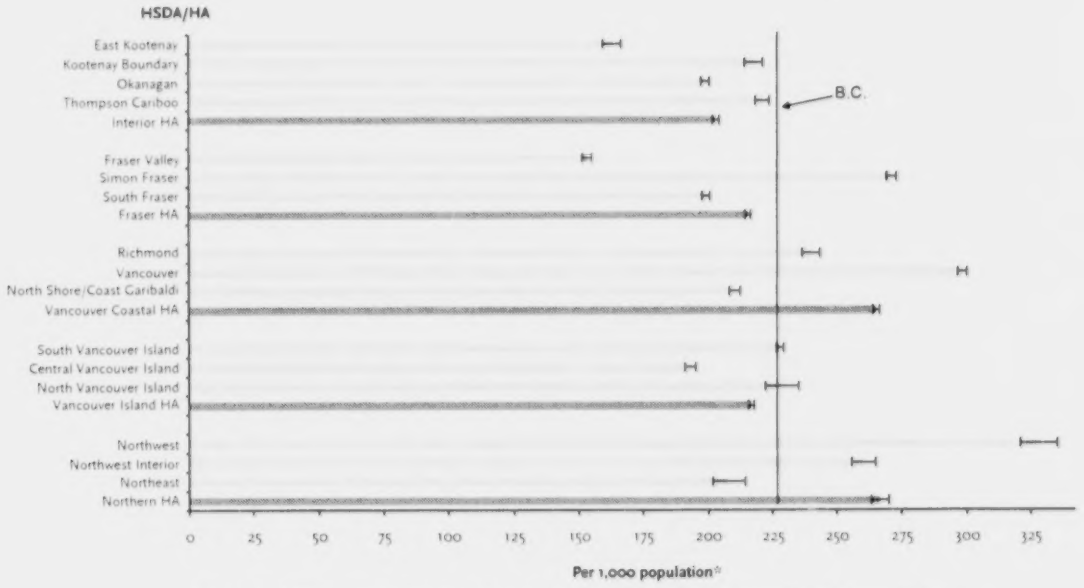
* With 95% Confidence Interval. Source: B.C. Vital Statistics Agency

FIGURE 14. **HOSPITAL CASES, FALLS IN SENIORS AGED 65+ YEARS, BY HEALTH AUTHORITY (HA) AND HEALTH SERVICES DELIVERY AREA (HSDA), B.C., 1996/97-2000/01**



Source: Acute/rehabilitation separations from the 1996/97 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database.
*with 95% confidence interval

FIGURE 15. **HOSPITAL DAYS, FALLS IN SENIORS AGED 65+ YEARS, BY HEALTH AUTHORITY (HA) AND HEALTH SERVICE DELIVERY AREA (HSDA), B.C., 1996/97-2000/01**



Source: Acute/rehabilitation separations from the 1996/97 to 2000/01 Canadian Institute of Health Information Discharge Abstract Database
*with 95% confidence interval

Northern Health region. At first glance this might be interpreted to indicate that those elderly people who are most severely injured by falls are sent to tertiary hospitals in Vancouver and their recovery is longer. However, patients injured in other regions do not appear in the Vancouver Coastal data even if they were treated there. It is not clear why this pattern of longer hospital stays in some areas has emerged but it may have more to do with the availability or unavailability of other health service resources – such as long-term care placement or home support services in the different health regions – than with the severity of the fall injury. Other factors such as climate, terrain and lifestyle also play a part.

INTERIOR HEALTH REGION TARGETS FALL REDUCTION

As part of its new Population Health Plan, the Interior Health Authority is focusing on fall reductions as one of four priority areas for preventive health programs. The goal is to improve the health and wellness of the population by putting in place programs to prevent fall-related injuries from occurring. Planned activities include best practices workshops, falls prevention programs at all residential facilities in the East Kootenay region and community programs for frail elderly in select communities in Kootenay boundary. Research will include a pilot home support worker training project, evaluation of a community project in the North Okanagan, and the setting of measurable targets to monitor performance in reducing falls. If the programs can reduce the number of hip fractures by just 30, they will save $840,000 in health costs.

Health Authority staff requiring more in depth injury-related data for their region can direct their requests to the B.C. Injury Research and Prevention Unit or call 604-875-3776. Another source of information for regional patterns and trends is the BCIRPU report called *Unintentional Fall-Related Injuries and Deaths Among Seniors in British Columbia: Trends, Patterns and Future Projections 1987-2012.*

EMERGENCY ROOM SURVEILLANCE DATA ABOUT FALLS IN B.C.

As the previous pages of charts illustrate, the majority of information about the impact, number and severity of falls is derived from mortality and hospitalization data. As with all injuries, this information does not reflect the full extent of the problem for falls. Hospitalization and deaths for falls are just the "tip of the iceberg" as shown by the Injury Pyramid.

In B.C. we know that for every death that results from a fall among persons aged 65 years and older, there are approximately 34 hospital admissions and 56 emergency visits in which people are treated and released. We do not have figures for those fall injuries that are treated in clinics or doctors' offices, nor for those treated at home or not treated. We do know, however, that the majority of fall injuries go unreported and untreated.

FIGURE 16. **INJURY PYRAMID**

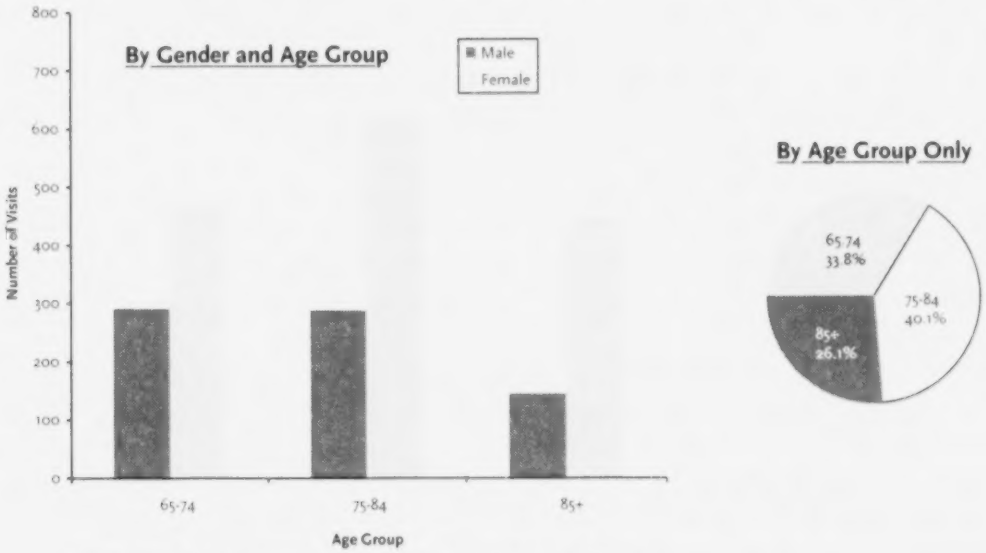
Since treatment in Emergency Rooms accounts for a large number of injury treatments, it is important to collect data in this setting to better understand the impact of falls.

The B.C. Injury Research and Prevention Unit is coordinating the Emergency Department Injury Surveillance System (EDISS). Under this program, funded as a pilot project by Health Canada and the B.C. Ministry of Health Planning, 10 emergency departments in the Fraser, Northern and Interior health regions are collecting data about the types of injuries, the gender and age of the person injured and what they were doing at the time of the injury. This will help understand the nature and extent of injuries in B.C. and design, plan and evaluate injury prevention programs. The EDISS program, now in its final year of pilot funding, is providing invaluable evidence that will help design, implement and evaluate future injury prevention policies and programs.

MAJORITY OF SENIORS' EMERGENCY VISITS FOR FALLS

In the data collected from 10 emergency departments over one year (from April 1, 2001 to March 30, 2002), there were 59,129 visits for injury for all ages and 4,066 of these were for persons aged 65 years and older. Of the 4,066 visits by those aged 65 years and older, 2,259 or more than half were for fall-related injuries. The EDISS data only relates to those treated and released in the 10 emergency departments – not those who visited the emergency department and

FIGURE 17. **EDISS FALL-RELATED VISITS, AGED 65 YEARS AND OVER, APRIL 1 2001 TO MARCH 31 2002**



Data collected over one year in 10 Emergency Departments for those who visited the emergency department, but where not admitted to hospital. N = 2,259 (date missing for some categories). Percentage calculated from all patients aged 65+ years.

FIGURE 18. **EDISS NON-ADMITTED FALL-RELATED INJURIES, AGED 65 YEARS AND OVER, APRIL 1 2001 TO MARCH 31 2002**

Data collected over one year in 10 Emergency Departments for those who visited the emergency department, but where not admitted to hospital. N = 2,259 (date missing for some categories). Percentage calculated from all patients aged 65+ years.

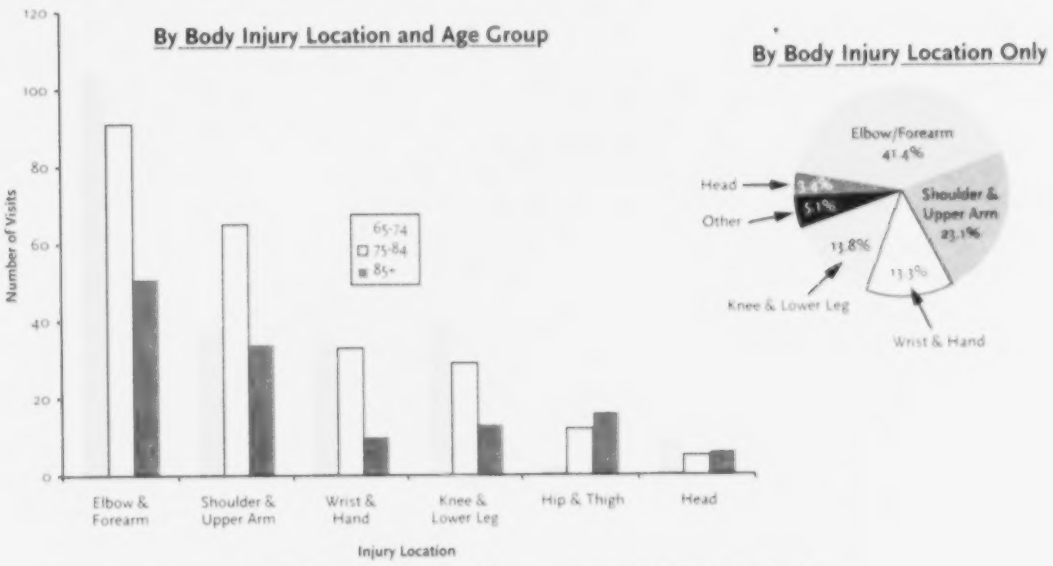
were subsequently admitted to hospital for further treatment of their injuries.

As Figure 17 shows, the majority of those aged 65 and over who were treated and released for fall-related injuries were between the ages of 75 and 84 years. The number of elderly women treated for fall injuries exceeded those of elderly men in all age groups, with the greatest difference being for those aged 85 years and older. This perhaps reflects the reality that fewer men than women live past 85.

Figure 18 illustrates that the majority of fall-related injuries that were treated and released in the emergency departments were fractures (34 per cent) and superficial injuries (22 per cent), such as bruises and cuts that did not require suturing. Open wounds that required suturing accounted for 19 per cent of injuries. Difference by age group for injury type shows a mixed pattern. As these are cases and not rates, it is difficult to attribute the prevalence of injury types seen in emergency departments by age group. However, it is interesting to note that 178 persons aged 85 years and older who sustained a fall-related fracture were treated and released from the 10 emergency departments over a one-year period.

Figure 19 shows that the most common parts of the body injured by a fall among patients who were treated and released from the 10 emergency departments were to the elbow and forearm, followed by shoulder and upper arm and then thorax and trunk. Differences by age groups show that fall-related injuries to the hip and thigh is the only category where the prevalence is higher among those age 85 years and older compared to the younger age groups.

FIGURE 19. **EDISS NON-ADMITTED FALL-RELATED INJURIES, AGED 65 YEARS AND OVER, APRIL 1 2001 TO MARCH 31 2002**



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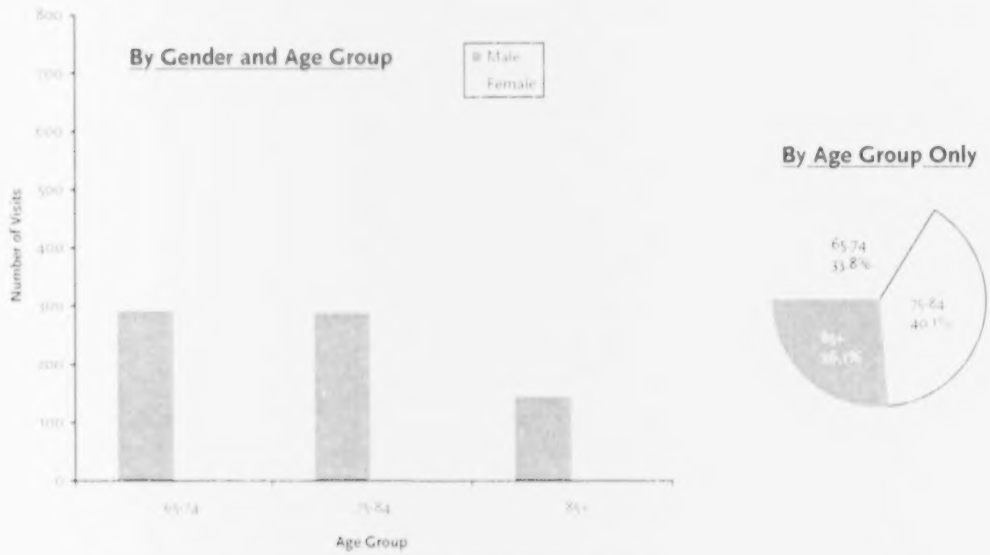

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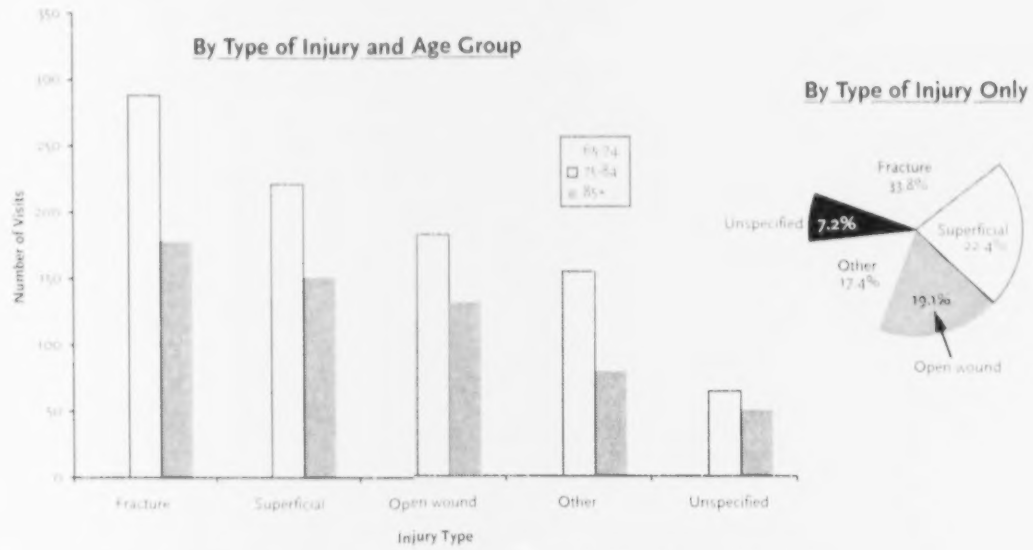

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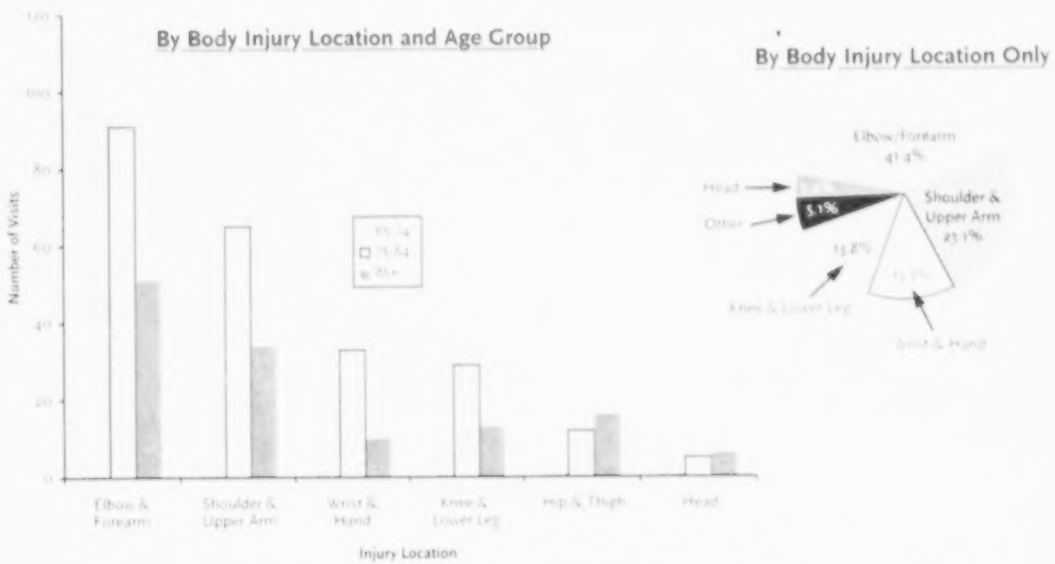
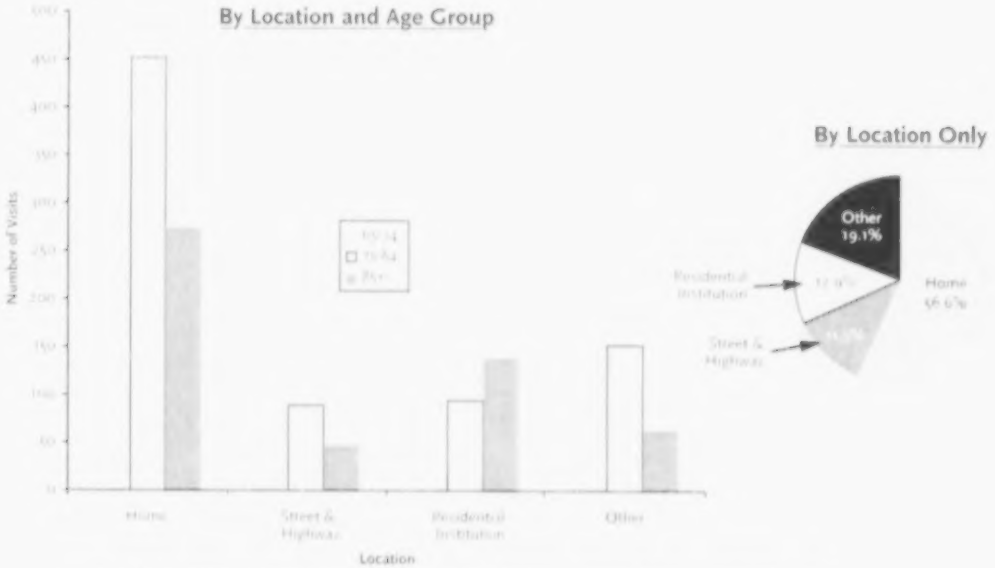


FIGURE 20. **EDISS NON-ADMITTED FALL-RELATED VISITS AGED 65 YEAS AND OVER, APRIL 1, 2001 TO MARCH 31, 2002**



As Figure 20 shows, the majority of seniors of all ages were injured in their homes (57 per cent) with the remainder relatively evenly divided among injuries on the street or highway, in residential institutions, and in other locations, such as shopping malls, public buildings or other areas outside the home. It is not surprising to note that the majority of those who sustained fall related injuries in residential institution locations were aged 85 years and older, as this location primarily consists of long-term care facilities for those with multiple chronic health problems.

The above EDISS data on fall-related injuries are preliminary and a final report will be posted on the BCIRPU Web site at www.injuryresearch.bc.ca when the pilot project is completed. Links are also being created with the National Ambulatory Care Reporting System (see box) to facilitate the sustainability of the EDISS program.

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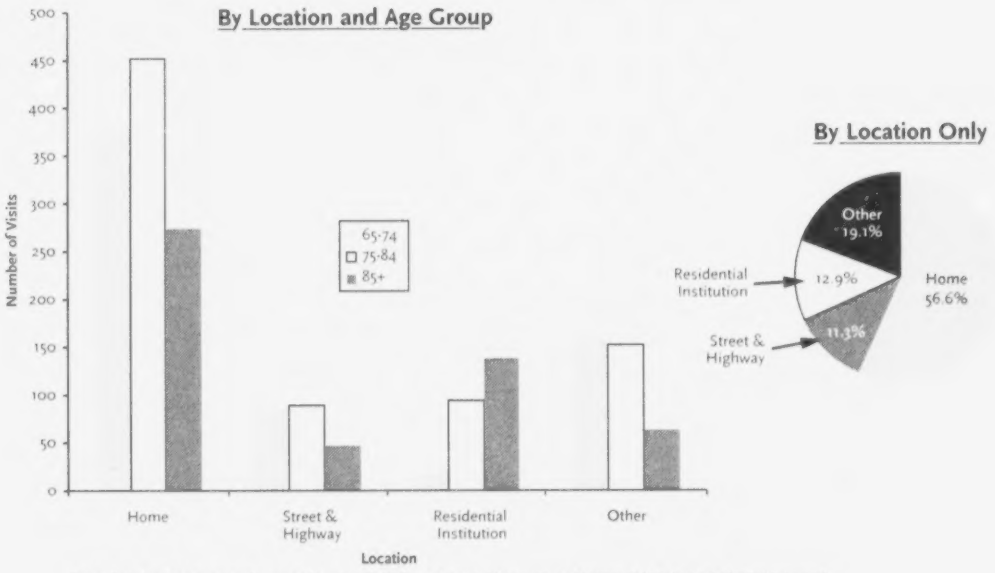

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NATIONAL AMBULATORY CARE REPORTING SYSTEM

The National Ambulatory Care Reporting System (NACRS) has been developed by the Canadian Institute of Health Information (CIHI) to collect data on the number of patients receiving ambulatory care services in emergency departments, outpatient clinics and day surgery. This type of care has grown significantly in recent years, to become the largest volume of patient activity in Canadian health care. However, traditional data collection systems do not capture the nature or extent of this activity. NACRS, though still in its infancy, will fill an important information void and is designed to do the following:

- Provide accurate and timely information that is needed to establish sound health policies, manage the health system effectively and create public awareness of the factors affecting good health.
- Collect, process and analyze summary data on hospital ambulatory care.
- Support management decision-making at the hospital, regional and provincial/territorial levels.
- Facilitate provincial and national comparative reporting.
- Support research activities to improve the understanding and functioning of the medical and economic basis of the health care system.

Ontario mandated the use of NACRS by hospital emergency departments in 1999. In some emergency departments in B.C. it has been voluntarily adopted. The EDISS pilot project used the data elements relating to injuries that are part of NACRS. In order to improve understanding of the volume and nature of injuries in B.C., such as the extent and impact of falls, and the circumstances leading to falls, it is essential that NACRS be adopted across the province. Without good data about injuries in B.C., it is difficult to design, implement and evaluate prevention programs. A recommendation to adopt NACRS across the province forms the basis of one of the recommendations in the final section of this report.

3. Risk Factors for Falls

It is clear from the preceding pages that falls among seniors compose a significant burden of injury in British Columbia. By understanding the risk factors that increase the likelihood an elderly person will fall, we can better target prevention programs to reduce the number of falls.

Evidence for risk factors have been derived from more than 60 observational studies. It is common to divide the risk factors into intrinsic risks (related to the health of the individual) and extrinsic (related to the person's environment) (Gillespie et al., 2001).

Researchers in Canada, however, tend to further divide intrinsic and extrinsic factors in to four categories of risk factors that reflect the broad determinants of health:

- biological/medical risk factors,
- behavioural risk factors,
- environmental risk factors and
- social and economic risk factors.

The separations between these categories are somewhat arbitrary and most fall-related injuries result from overlapping and compounding effects of multiple risk factors. Some risk factors – such as advancing age – cannot be changed, but other risk factors – such as the amount of exercise one does, or public building standards – can be changed (Scott et al., 2001).

BALANCE AFTER A STROKE

Up to 40 per cent of people who have a stroke have a serious fall within the next year. New research suggests that being unable to balance while getting dressed, or experiencing dizziness and a "spinning sensation", accounts for many of stroke survivors' falls. An analysis of prospective falls among 124 women recovering from a stroke found that women with balance problems while dressing were seven times more likely to fall. Those who experienced "spinning" sensations were five times more likely to fall. The researchers recommended that women recovering from strokes take their time while dressing, and sit down, particularly while putting on pantyhose (Lamb et al., 2003).

BIOLOGICAL/MEDICAL RISK FACTORS

The natural aging process and the effects of acute and chronic health conditions increase the risk that an elderly person will fall, or sustain an injury in a fall. A review of the research literature indicates the following biological risk factors:

- **Advanced age** – Those over 80 are the most likely to fall and be injured.
- **Gender** – Women tend to fall more often than men and sustain more injuries.
- **Chronic and acute illness** - Chronic diseases, such as Parkinson's disease, arthritis, osteoporosis, heart disease and stroke, bowel and bladder incontinence, blood pressure problems and other diseases, as well as short-term illnesses such as flu and infections can cause increased frailty and physical impairment. For example, research shows that 40 per cent of people who

have a stroke will have a fall within a year of their stroke (Lamb et al., 2003). The medications used to treat certain illnesses can also predispose some people to falling, as described in more detail in the section on medications.

- **Physical disability** – The risk of falls increases with some of the physical effects of aging, including: gait disorders; diminished touch and sensation from limbs, muscles and feet; poor hearing; poor balance; dizziness; postural hypotension; injuries from a previous fall; sore feet and other foot problems.
- **Muscle weakness and diminished physical fitness** – Falls increase with a loss of muscle strength, balance, flexibility and coordination, particularly weak limbs. Risk factors include tiring easily with exertion and the inability to easily accomplish activities of daily living such as feeding oneself, dressing, bathing, getting out bed, toileting and walking.
- **Vision changes** – Reduced vision, poor depth perception, bifocal and multifocal lenses, and ill-fitting glasses or an out-of-date lens prescription may all increase the risk of an elderly person misperceiving a trip hazard, and falling as a result.
- **Cognitive impairments** – Alzheimer's disease and other disorders that diminish alertness or mental capacity increase the risk of falls.

STAIRWAYS TO INJURY

Steps and stairs are among the most frequent sites of falls and the leading category for mortality from falls in British Columbia. According to Jake Pauls, a US-based safety consultant who specializes in stairs, one stair-related death occurs for every million hours of use, making stairs more dangerous than cars. Home stairs account for about 87 per cent of all hospital-treated stair-related injuries, where location is known (Pauls, 2001). Problems include:

- Visibility - Poor lighting, glare, and lack of contrast in step colour can cause people to misjudge or overstep stairs.
- Riser height – Non-standard stair dimensions can cause people to misstep. The 1995 building code of Canada established a 7-inch rise and 11-inch tread for large public buildings. But, this code does not apply to many private or smaller buildings. Pauls notes that adopting a 7/11 code for stairs in all buildings could reduce falls by 25 per cent.

In Canada each year, about 100,000 people are treated in hospital for a stair-related injury of which 5,000 require a hospital admission. Each year, about 500 people in Canada die after falling on stairs (Pauls, 2001).

BEHAVIORAL RISK FACTORS

Behavioral risk factors are as simple as the choice of footwear, attempts to prune a tree or reach an object on a high shelf. These risks can also include life-style factors such as alcohol use, poor diet and lack of exercise, or the use of high risk medication or multiple medications that predispose some seniors to falling. It can be difficult for seniors, who may feel no different than they felt in younger years, to realize that the seemingly ordinary choices they make and the actions they take may greatly increase their chance of falling.

Based on a review of the research literature (Scott et al., 2001) the most common behavioral risk factors are:

- **Risk-taking behaviors** – Elderly people who do not recognize their changing physical abilities and attempt to do too much can set themselves up for a fall. Clearing snow and ice off a walkway, pruning trees, climbing ladders, climbing a chair or unsteady stool to reach objects or clean surfaces, walking without a mobility aid when one is needed, inappropriate use of a mobility aid, or not using available aids such as hand rails or grab bars, are all risky behaviors for seniors. This is particularly true if seniors' physical abilities are declining or if their bones are weakening from osteoporosis or osteopenia, which can increase the chance of a fracture from a fall.
- **Medication use** – The use of benzodiazepines, tri-cyclic antidepressants and multiple prescriptions all increase the risk of falls, fall-related injuries and hip fractures. New data from B.C.'s PharmaCare – which suggests that acute illnesses requiring anti-infective medications such as antibiotics are associated with a higher risk of falls – sheds further light on this issue (see medication use and falls in B.C. presented later in this section).
- **Inattention** – Not paying attention to one's surroundings increases the chance of falling, particularly in new surroundings or in transition zones, such as entering doorways or changing elevations from one level to another.
- **Alcohol use** – Seniors who drink alcohol, especially those who drink to intoxication, have a greater risk of falling.
- **Inappropriate footwear** – Loose fitting shoes or slippers, shoes with slippery soles, high heels, shoes with thick soles, or frequent changing of shoe styles (for example, from heels to sandals to runners) can increase the risk of falling.
- **Handbags** – Evidence is emerging that heavy, awkward purses and handbags used by elderly women can throw off their balance and make them more susceptible to a fall.

RICHMOND SENIORS IDENTIFY FALLS HAZARDS

The Richmond Seniors Advisory Council, in their review of a draft of this report, identified additional tripping hazards that are easily correctible: wearing a nightgown that is too long (cut it off); wearing shoes with laces (use Velcro fasteners); and folding back a bedspread so that it does not touch the floor but instead folds back on the bed.

- **Inadequate diet/exercise** – Not eating enough healthy food to keep oneself strong, an inadequate intake of protein or water, or not doing enough physical activity to ward off the loss of muscle mass or loss of bone density can increase the risk of falls and injuries.
- **Fear of falling** – The fear of falling again, as a reaction to a previous fall, can lead to inactivity that puts the person at increased risk of future falls.

ENVIRONMENTAL RISK FACTORS

A person's surrounding environment can harbor risks that increase the chance of falling. This includes the furnishing, design or upkeep of homes, as well as risks in the neighborhood or community and risks within public buildings. A review of the research literature (Scott et al., 2001) identifies the following key environmental hazards:

- **Home hazards** – Throw rugs; loose carpets; electrical cords; door sills; pets; cluttered floors; poorly lit or poorly designed stairs; slippery floors; shower stalls or baths; lack of aids such as grab bars or hand rails.
- **Community hazards** - Uneven pavement or surfaces; sidewalk cracks; tree roots; snow or ice on walks or steps; building mats; door sills; unsafe stair design; uneven steps; poorly lit walks and stairways or sharp contrasts; slippery surfaces; poor building design; lack of handrails, grab bars, curb ramps and rest areas; obstacles such as planters, bike racks, bus shelters, garbage cans, flower boxes, pedestrian islands; or leaves that obscure changes in pavement, or become slippery when wet.
- **Institutional hazards** – Poorly designed or maintained buildings; inadequate building codes; poor enforcement of codes or safety regulations; lack of hand rails or grab bars; slippery floors; poor lighting; glare from surfaces; lack of rest areas; beds that are too high; lack of storage for equipment that consequently clutters rooms and hallways.

CITY SPACES AND BUILDINGS NOT DESIGNED NOR BUILT FOR ELDERLY OR DISABLED NEEDS

Members of the general public who are fit, healthy and have good eyesight may not recognize what constitutes a falling hazard to an elderly or disabled person. Sometimes, even those who work to modify public spaces can inadvertently create or increase a hazard. For instance, the decision to paint a bike rack gray instead of bright yellow can make it less visible to an elderly pedestrian, leading to a trip or fall. Small cracks or slight unevenness in pavement can be more hazardous than large breaks because cracks are less likely to be seen. Public buildings, even hospitals themselves, may not be "elder-friendly" despite being wheelchair accessible. Lack of handrails, uneven transitions through doorways, or slippery floors can make it difficult for the elderly to get around and can contribute to falls risks. Those who have the ability to modify public spaces must work with those at risk to understand the abilities of their most frail and disabled users.

SOCIAL AND ECONOMIC RISK FACTORS

The study of the social determinants of health has repeatedly shown that one's income, education, housing and social connectedness all bear a strong relationship to one's health, level of disability and longevity. People with low income, low education, inadequate housing, a lack of support networks or lack of access to appropriate health or social services are all at a greater risk for the chronic health conditions that are, in turn, risk factors for falls. The role that social and economic factors play in contributing to falls is poorly understood. However, contributing factors may include illiteracy – resulting in an inability to benefit from printed resources on strategies for preventing falls – or muscle weakness or ill health due to lack of funds for a nutritional diet.

FOCUSING ON MEDICATION USE IN RELATION TO FALLS IN B.C.

Numerous studies over the years have highlighted the number and types of medication consumed by seniors as contributors to the risk of falls and subsequent injuries (Ross, 1991; Leipzig et al., 1999). We know medication use increases with advancing age due to the greater prevalence and severity of health problems among the elderly (Rosenberg & Moore, 1997). In addition to taking more drugs, older people also develop a heightened sensitivity to drug effects (Ray et al., 1990). With advanced age there is an increase in both the half-life (the amount of time the drug remains in the body) and the active levels produced by a given dose (Ray et al., 1990). Also, age-related losses of gastrointestinal,

SLEEPING PILLS AND FALLS

Numerous studies over the last decade have found that falls are highly associated with the use of tranquillizers, anti-anxiety medication or drugs used to fight insomnia, particularly the class of drugs called benzodiazepines. The drugs include alprazolam (Xanax), chlordiazepoxide (Librium), diazepam (Valium), and lorazepam (Ativan) (Koski et al., 1996; Neutel et al., 1996; Oster et al., 1990; Ray et al., 1989). Widely prescribed to the elderly to help reduce anxiety and treat sleep problems, sometimes following the death of a spouse, hospitalization for illness, or upsetting life events, benzodiazepines can take a number of hours to be cleared from the body, leading to mental confusion, drowsiness or lack of coordination. Even the use of short-acting "benzos" have a greater association with falls and hip fractures. Doctors should use extreme caution when prescribing these drugs to the elderly, and the elderly patient should be made aware of the drug's risks and the need to use them only for a short duration (Leipzig et al., 1999). Withdrawal of drugs such as benzodiazepines should also be done with care to prevent withdrawal symptoms.

hepatic or renal function predispose older persons to adverse drug reactions (Ray et al., 1990).

For this report, a preliminary analysis of PharmaCare data was conducted concerning medications prescribed within 30 days prior to a fall-related hospital admission for those aged 65 years and over; this was then compared to medications prescribed 30 days prior to their birth date for all B.C. seniors who had not been admitted for a fall injury. The findings showed a strong association between prescriptions filled for anti-infective medications and fall-related admissions, with a higher relative risk than any other group of drugs. This preliminary evidence suggests that there may be increased fall injuries among seniors who have an acute illness requiring a prescription for anti-infectives.

These findings may point to a need for prescribing clinicians or pharmacists to provide patients with information on how to avoid a fall during an acute illness. This information would include such precautions as rising slowly when getting up from a bed or chair, using mobility aids, or obtaining assistance with walking if patients are feeling unsteady on their feet. Those with a fever should also drink at least six glasses of liquid (36 fluid ounces) a day – preferably water and not tea or coffee – and gradually rebuild muscle strength before taking on normal physical activities.

ARE YOU AT RISK?

Mr. M was a fit and active 77 year old who continued to ski, hike and do heavy yard work. One weekend while moving rocks in the garden, he lost his footing on a slippery rock, fell and broke his ribs, precipitating a decline in his health and fitness. "I thought I didn't have to worry," he said.

Findings from the preliminary analysis are also consistent with the research literature on higher fall risks for seniors who are prescribed psychotropic drugs such as paroxetine (Paxil), amitriptyline (Elavil), sertraline (Zoloft), loxapine (Loxitane); the literature shows that seniors taking these drugs were also more likely to sustain a fall. The drug category of anxiolytics, sedatives and hypnotics (of which 90 per cent are benzodiazepines) also emerged in the PharmaCare data as being more likely to be associated with a fall, either on their own or in combination with other drugs. Continued warnings about the hazards of this class of drugs in relation to falls must be promoted among prescribing physicians, dispensing pharmacists and among elderly persons receiving these prescriptions.

FAMILY AND FRIENDS CAN HELP

Mrs, S, a very fit, healthy, independent and active 90 year old kept falling over in the street while walking, fortunately without serious injury. She refused to carry a stick or cane. After her family persuaded her to walk more slowly, take longer steps and buy some new shoes, her falling ceased.

More research needs to be done in order to better understand the relationship between anti-infectives and the higher rate of falling. Since there are a number of limitations in these analyses, including a lack of control for age, co-morbidities

or residential status, it is recommended that the association between medications taken prior to hospital admission and the risk of fall injury be investigated further. It is also important to note that these new data cannot be used to attribute the cause of falls to certain medications or illnesses. Rather, these data only illustrate a high level of association (not causation) between various prescriptions and a higher rate of falling. Further investigation of these findings is necessary, preferably using prospective studies and hypothesis testing, to determine whether the differences are statistically significant.

FOCUSING ON WHERE FALLS TAKE PLACE

Falls can occur in the home/community setting among both the well elderly and the frail elderly, as well as in acute care hospitals or in long-term care institutions. Understanding the interaction between the risk factors and the settings where falls take place can help tailor effective prevention strategies designed to reduce the incidence of falls.

MOBILITY AID HAZARDS

Mrs. D, 87, was delighted with her new walker, which had a seat she could rest on during her daily walk to her local store. One day, however, she neglected to set the brake and as she sat down the walker moved away. She landed hard on the ground, breaking her hip.

FALLS AMONG THE WELL ELDERLY IN THE COMMUNITY

Many British Columbians over the age of 65 are aging well, and continue to be active, fit and healthy. Surveys of the well elderly in other regions (Alder Group 2002, Commonwealth of Australia, 2001) have found that while the well elderly understand the general risk of falls, they do not perceive themselves to be personally at risk. This feeling of confidence can itself be a risk factor. As noted in the 2001 Australian survey: "Ironically, those who do not identify themselves as being 'old' and who have not precluded themselves from their general daily activities are in fact at an elevated risk of falling when compared to the group of older people who appear to have taken the persona of an 'older person'". This may be because the latter group, who accept normal age-related declines in physical function, take the necessary precautions for safety (such as using a cane or walker to promote good balance), while the former group may have increased exposure to situations that can cause falls and may take greater risks.

The well elderly may be more apt to engage in risky behaviour because they see no reason to limit the scope of their activities, despite a gradual decline in strength, agility and balance. They may climb ladders to prune a tree or clean out an eaves trough or attempt to clear a walkway of snow or ice. They may pay less attention to environmental hazards because they are not worried about a pet underfoot, an uneven sidewalk or a poorly lit or poorly designed staircase. They may

not even think about the design or safety of the footwear they choose and may be reluctant to start walking slowly, using a cane or wearing a pair of hip protectors.

A survey of Ontario seniors (Alder Group, 2002) found that many of the respondents over-estimated their level of fitness and under-estimated their loss of visual acuity. Since many seniors feel fit and healthy, they may not recognize subtle deteriorations in their strength, coordination and balance that make them less able to catch themselves if they trip or slip. Since they do not perceive themselves to be at risk, they may not take precautions and may be less likely to respond to public education campaigns encouraging awareness and prevention of the risks of falling. The Australian survey of attitudes concluded that one of the greatest challenges is to alert the well elderly to the issue of falls and possible interventions – without inducing a detrimental change in their positive attitude that might itself result in a reduction of healthy activity and a lessening of mobility.

TWO PROGRAMS HELP SENIORS ADAPT LIVING SPACE

The Canada Mortgage and Housing Corporation (CMHC) provides financial assistance to seniors on limited incomes, for home modifications. **The Home Adaptations for Seniors Independence (HASI)** program pays for such modifications as installation of handrails and grab bars, lever handles on doors, and easy-to-reach storage. CMHC also operates the **Residential Rehabilitation Assistance Program** for Persons with Disabilities, for homes requiring extensive modifications such as wider doorways to accommodate a wheelchair. To find out about qualifying for these programs, call CMHC in Vancouver at 604-731-5733.

Veterans may qualify for a home modification program called **Veterans Independence Program**, offered by Veterans Affairs Canada District Offices, or in Vancouver at 604-666-7942.

FALLS AMONG THE FRAIL ELDERLY IN THE COMMUNITY

The highest risk of falling is among people who are mobile but unsteady on their feet (Tinetti et al., 1995). For the frail elderly living in the community, the inter-relationship of all the risk factors – biological, behavioural, environmental, social and economic – can make their entire world seem like a fall waiting to occur.

The use of mobility aids such as walkers, canes, scooters and wheelchairs can reduce the risk of falling, while increasing independence and activity levels. However, when used improperly these aids are also associated with an increased risk of falls. The reasons for this include the use of aids by people with limited abilities, not having a proper assessment to ensure the mobility aid is suited to an individual's specific needs and abilities, or improper use, such as failing to set a brake on a walker or a wheelchair.

A recent Canadian study on seniors' experiences and values concerning assistive devices found that most seniors thought that such devices symbolized loss of independence, disability and inevitable decline (Gallagher et al., 2003). They indicated that the look and appearance of some of the devices contributed to this negative perception. Personal realization of the need for a device tended to occur after a crisis event – such as a fall – or through caregiver, family or health professional recommendation, intervention or referral. A full copy of this report can be viewed at: www.injuryresearch.bc.ca

At the Provincial Health Officer's regional consultations, physiotherapists and occupational therapists emphasized the importance of careful choice of assistive devices, tailored to the needs of the individual. Advice on the selection of appropriate devices is available from these professionals.

FALLS IN ACUTE CARE HOSPITALS

Research evidence suggests that acute illness and hospitalization may increase the risk of falls (Evans et al., 1998; Gaebler, 1993). Not much is known about the extent and nature of this risk. The analysis of the hospital Discharge Abstract Database for B.C. did not enable us to determine which falls may have occurred within the acute care setting as all institutional settings are clustered together. Furthermore, since most of the research conducted among institutionalized elderly tends to focus on those in long-term care. However, a number of factors been identified suggests that hospitalization and the weeks immediately after discharge may be a high-risk period. The following events are likely to happen during hospitalization, often predisposing elderly people to falls:

- **Acute illness:** Can cause sudden changes in physical health, abilities and functions (Tinetti et al., 1989).
- **Immobility and extended bed rest:** Can diminish coordination, body strength, slow reflexes and mobility, undermine balance and increase body sway, and cause postural hypotension (Deitrick et al., 1948; Taylor et al., 1949; Greenleaf et al., 1984). Staff shortages may make it difficult for elderly to obtain help to get out of bed and start moving and can contribute to reduced mobility and increased risk of falls.
- **Delirium:** Studies show that delirium occurs in up to 50 per cent of elderly patients in hospital and can persist once the patient returns home (Inouye et al., 1993).

- **Psychoactive medications:** Sleeping pills and other anti-anxiety medications are often started during hospitalization to help the elderly person rest in the new surroundings, but can also increase the chance of falling in the hospital and after discharge (Ray et al., 1989; Leipzig et al., 1999).

  The rate of falls is substantially increased in the first month after discharge from hospital (Inouye et al., 1993).

Although the quantity and quality of the evidence is limited, a review of the literature on falls in acute care settings highlights a number of patient characteristics that are associated with high rates of falls (Evans et al., 1998). Patients at higher risk include those who are confused, those who have previously fallen, those taking medications such as sedatives or analgesics, those with elimination problems such as incontinence or urinary frequency, and those with mobility deficits. The most common activity at the time of the fall appears to be transferring from a bed to a chair. However, evidence is not yet available to determine if reducing any of these risk factors leads to a reduction in falls.

FALLS AFTER DISCHARGE FROM HOSPITAL

The early weeks after an elderly person is discharged from an acute care hospital are a high-risk time for falls. One study found that acute care patients who were functionally dependent and needed professional help after hospital discharge were significantly more likely to fall compared to those who were independent and not requiring professional help (Mahoney et al., 1994). The rate of falls increased in the first month after discharge from hospital (ibid).

A more recent study of elderly patients discharged from hospital found the fall rate was more than four-fold higher in the first two weeks after hospitalization compared to three months after discharge. In the first month after discharge, 11 per cent of falls resulted in serious injury requiring re-hospitalizations and 15 per cent of all re-hospitalizations for the elderly were related to falls (Mahoney et al., 2000).

More research needs to be done to assess the incidence rate and fill knowledge gaps about the factors that contribute to falls in acute care settings, as well as falls that occur shortly after discharge from hospital. It is also clear that considerably more research is needed to determine the best practices for assessing people at high risk for falling in this setting, and for preventing these falls from occurring.

FALLS IN LONG-TERM CARE INSTITUTIONS

While falls are common in the community, they are even more common in long-term care institutions. In fact, it has been estimated, through systematic review of studies of falls in long-term care settings, that the institutionalized elderly fall three times more often than elderly in the community (Rubenstein et al., 1996).

Approximately 30 to 50 per cent of all long-term care residents fall each year and of these, 40 per cent fall twice or more each year (Tinetti, 1987; Aronow & Ahn, 1997; Kiely et al., 1998; Nygaard, 1998). Approximately 10 per cent of these falls result in serious injury and up to 5 per cent result in bone fractures (Butler et al., 1996; Thapa et al., 1998). The risk for sustaining a hip fracture is 10.5 times higher for women who are in facilities than if they were living in the community, and less than 15 per cent of facility residents who sustain a hip fracture regain pre-injury ambulatory status (Folman et al., 1994).

In a 1994 study, it was estimated that there are 1.5 falls per bed per year in long-term care institutions and nursing homes (Rubenstein et al., 1996). A facility with 100 beds, for example, would be expected to have about 150 falls among its residents every year.

The general public may have the impression that the elderly who live in institutions are better protected from the hazards of everyday living that come with increased age. However, there are a number of reasons why the institutionalized elderly may be more vulnerable to falling:

- **High level of frailty:** The most dependent and least ambulatory seniors tend to live in institutions.
- **Number of co-morbidities:** It is common for the institutionalized elderly to suffer from a number of disease processes that can increase their risk of falling.
- **Cognitive deficits common:** Alzheimer's disease, senile dementia and other disease processes that undermine mental competency make the long-term care population more prone to falling. Available evidence points to the effects of neurochemical degeneration caused by the dementia process, as well as the role of medications commonly taken by those with dementia, both of which impair balance, gait, judgment and reaction time (Oleske et al., 1995).
- **Inactivity common:** Maintaining muscle strength and physical abilities is difficult in institutional settings lacking the resources for on-site physiotherapists and exercise programmers.
- **Side effects of medications:** The elderly in institutions are often taking numerous medications, including benzodiazepines to help with sleep. These drugs can contribute to increased risk of falls. (Geriatricians can help reduce the number of medications that are prescribed for and taken by seniors.)
- **Care giver/patient ratios:** The elderly population in institutions is a highly dependent population. Poor care giver/patient ratios can mean that aid from care givers may not be available when the frail elderly patient attempts higher-risk activities which may lead to a fall (for example, getting out of bed on their own).

- **Availability of Physiotherapists and Occupational Therapists:** There may be limited availability of professionals who can assist a facility to design falls prevention programs and carry out assessments of individuals determined to be at risk of falling.

Current practices for recording falls and fall-related injuries in British Columbia's long-term care facilities need to be standardized to enable better data collection on the person, place, time and circumstances of a fall. We also need to be able to compare numbers over time and across institutions. This will enhance the ability to both apply and evaluate fall prevention strategies in the long-term care setting.

Some facilities in B.C. have already initiated their own falls surveillance so that they can assess at regular intervals the circumstances that may have contributed to falls and then initiate a prevention or quality of care improvement program.

4. Evidence for Prevention: What Works?

Over the last decade, a number of programs and strategies have been proposed and developed to reduce risks among the elderly as related to falling or sustaining fall related injuries. Programs vary in their approach and their target populations. Some address medical and behavioural risk factors, others address environmental or multiple factors. The majority of these programs have been aimed at elderly people living in the community. But recently, more attention is being paid to reducing the risk of falls in long-term care institutions and in acute care hospitals.

SYSTEMATIC REVIEWS OF THE RESEARCH LITERATURE

In order to prevent falls, we need to know which prevention strategies or approaches are most likely to work, and to be cost-effective.

In recent years, three prominent groups have performed systematic reviews of the international body of research on falls prevention and categorized the studies based on the levels of research evidence. The most recent review was conducted in 2002 by the RAND Group in California (RAND, 2002). Another review was prepared in 2001 on behalf of Canada's Federal/Provincial/Territorial Committee of Officials (Seniors) for the Ministers Responsible for Seniors; this review resulted in a Canadian Best Practices Guide (Scott et al., 2001). In addition, a systematic review of evidence-based fall prevention interventions was conducted for the Cochrane Collaboration (Gillespie, 2001). Researchers for the National Aging Institute in Australia also conducted a systematic review of all the fall prevention literature (Hill et al., 2001) but its findings were similar to the three North America reviews and are not discussed in depth here.

All the reviews surveyed much of the same literature and used similar standards to categorize the levels of evidence. The RAND review, for example, screened 774 articles, rejecting all but 80 for various reasons (for example, not a Randomized Control Trial (RCT), re-reporting of the same research, studies focused on fall observation but not prevention, etc.). Out of those 80, a further 46 were rejected because they did not include the reduction of falls as an outcome, were duplicate studies,

SYSTEMATIC REVIEW

A systematic review is the highest level of scientific study and aims to answer a clear question – such as which fall prevention strategies are helpful – by finding and describing all published and, if possible, unpublished work on a topic.

In particular, it focuses on the levels of evidence available, such as the number and quality of Randomized Controlled Trials (RCTs) that have examined a particular strategy. A systematic review combines the data from several RCTs in the same area to compare the results and check for reliability. The greater the number of high quality research trials with the same outcomes in the same area, the more reliable the evidence.

presented data in aggregate form, or were not statistically significant. Ultimately, 34 studies contributed data to the meta-analysis.

The Canadian Best Practices Guide used a multi-step process to screen and evaluate documents and 674 documents met the initial screening. To be judged as relevant for systematic review, a study had to describe an intervention designed to reduce falls or fall-related injuries among community-dwelling seniors and to evaluate the interventions using falls or fall-related injuries as an outcome. Ultimately 34 studies were judged as relevant for the Canadian Best Practices Guide.

The Cochrane Review did an extensive review of all randomized controlled trials up until 2000 involving interventions with the elderly in the community, hospital or in long-term care settings, and measured falls or fall related injuries as an outcome (not intermediate measures such as improved balance). Ultimately 40 studies met their inclusion criteria.

All three systematic reviews noted the challenges to conducting research and evaluating the different types of fall prevention studies. These challenges included the following:

- Studies typically evaluated a strategy rather than an entire program for reducing falls and fall-related injuries.
- A reduction in risk factors does not necessarily lead to reductions in falls and fall-related injuries.
- Although falls are common, the relatively low incidence of injuries (average 20 per cent) resulting from all falls means that only very large studies can detect differences in fall-related injuries. Although it may be expected that an overall reduction in falls would lead to a reduction in fall-related injuries, there is little data to support this claim one way or another.
- Studies done for one population (for example, the cognitively intact) may not be applicable for another populations (for example, those with cognitive impairment).

In general, fall prevention strategies can be grouped into the following categories:

- **Exercise programs:** These include such activities as moderate weight lifting, Tai Chi, balance training.
- **Environmental modification:** These include removing risks from the home and the community. For example: adding grab bars, stair rails, curb ramps; removing rugs, cords, clutter; and painting pavement cracks and street obstacles bright colours.
- **Education:** Informing seniors and health providers about the risks through information campaigns and health promotion activities.
- **Medication modification:** Helping seniors withdraw from benzodiazepines and other drugs; altering prescriptions to avoid interactions; taking vitamin D and calcium supplements or bone enhancing medication, especially for those with documented osteoporosis.
- **Clinical Intervention:** Clinical assessments by nurses and doctors to identify seniors at high risk of falling; screening in emergency wards, doctors' offices and clinics for cognitive and physical fall risk factors; often combined with interventions to reduce behavioural or environmental risk factors.
- **Assistive devices/protective devices:** The correct use of walkers, canes, scooters to prevent falls; the use of hip protectors to cushion the hip from the impact of a fall.

- **Multifactorial intervention:** Combining a number of interventions such as any one or all of exercise programs, environment and behavioural modification, medication withdrawal, assistive device use and clinical assessment.

In general, the systematic reviews have found the following evidence-based results:

- The use of thorough, focused clinical assessments can help identify and then reduce the risk of falls, if followed up by targeted intervention, such as exercise or environmental modification (multifactorial interventions).
- Exercise programs can be an effective prevention strategy, but more research is needed to determine if one type of exercise is more effective than others and which exercises are best for seniors with chronic health conditions or disabilities.
- Environmental modification can be effective, particularly if the senior has manual or financial help to modify their environment.
- There is insufficient evidence to conclude whether education alone is an effective intervention, but it does play a role as part of a multifactorial strategy that includes clinical assessment followed by targeted intervention. The benefits of staff education have not been well tested in long-term care.

In the following pages, we examine in depth the rationale behind each type of intervention and the evidence for its effectiveness in the research literature.

TAI CHI – REDUCING FALLS

Research evidence resulting from the National Institute on Aging's FICSIT trials supports the use of Tai Chi to reduce the incidence of falls and increase the functioning and sense of well-being in elderly people.

In one randomized controlled study, a group of 200 seniors, 70 years and older, who underwent Tai Chi training (a form of Chinese martial arts) two times a week for 15 weeks reduced falls by 47.5 per cent compared with a matched group that attend a discussion-only meeting (Wolf et al., 1996). Wolf noted that more than half of the participants chose to continue Tai Chi after the study's completion.

A second FICSIT study, by Leslie Wolfson, M.D., and colleagues at the University of Connecticut Health Center, Farmington, found that several interventions to improve balance and strength among older people were effective. These improvements, particularly in strength, were preserved over a 6-month period while participants did Tai Chi exercises (Wolfson, 1996).

EXERCISE/PHYSICAL THERAPY INTERVENTIONS

Since many falls can be attributed to muscle weakness, loss of balance, fatigue with exertion and declines in physical functioning among the elderly, it is logical that exercise programs might delay or reverse physical decline and so prevent falls.

Research studies have supported both general physical activity, such as walking, cycling, mild aerobic movements or other endurance activities, and specific exercise regimes that are geared towards balance, strength or flexibility (RAND, 2002).

In the early 1990s, the U.S. National Institute on Aging launched an initiative to improve physical functioning in old age. Called Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT), the research featured eight clinical trails around the United States which produced some of the most convincing evidence for physical exercise, such as Tai Chi (see box).

In another study focusing on increasing strength and endurance, seniors rode stationary bikes, used weight machines, or did both three times a week for six months. Compared to a non-exercising control group, all three of the exercise groups were less likely to have a fall over the one-year follow up (Buchner et al., 1997).

The Cochrane review confirmed that evidence from three randomized controlled trials showed programs of muscle strengthening and balance retraining, individually prescribed by a trained health professional, were likely to be beneficial. It also supported the results of the FICSIT programs that a group Tai Chi program was also likely to be effective, but noted that there was insufficient evidence to assess the effectiveness of other group exercise interventions (Gillespie et al., 2001).

The Canadian Best Practices Guide concludes that while evidence supports exercise regimes – particularly balance training, weightlifting and Tai Chi exercises – more research is needed to determine the types of exercise programs that are most effective in managing the different types of balance and/or mobility problems.

MADE IN B.C. EXERCISE PROGRAMS

In 1997, an exercise program was developed in B.C. to help people with osteoporosis improve their strength, fitness and awareness, in order to prevent falls and fractures.

Called Osteofit, the program features simple and safe exercises to build balance, coordination and strength, as well as information and education to improve the client's confidence and knowledge. The clients are closely supervised and the instructors specially trained.

A randomized controlled trial conducted by Dr. Karim Khan and Dr. Heather McKay of UBC's Bone Health Research Group found that of 100 women age 70 and older, those who took the Osteofit program improved balance and strength compared to controls.

In another study by the same group, women age 75 to 85 years old who undertook supervised strength or balance training for six months reduced their fall risk score by more than 50 per cent.

The researchers conclude that exercise can be safe when properly prescribed, even in women with osteoporosis and previous fractures.

The researchers expressed caution that at least one exercise program – brisk walking for post-menopausal women – showed an increase in the number of falls (Ebrahim et al., 1997). Moderate walking was found to be protective among the 61,200 women followed in the Nurses' Health Study

SENIORS' HOME CHECKLIST

To reduce the risk of falling in your home:

Remove throw rugs or scatter mats, especially from high traffic areas or at the top of stairs. Put non-skid backing on any rugs you retain.

Keep high traffic areas clear of telephone and electrical cords, parcels, shoes, and other obstacles.

Do not wax floors, or use non-skid floor wax, and place non-slip surfaces on stairs, balconies, porches and patios.

Keep homes well lit, particularly stairways, porches, balconies, hallways, bedrooms. Have light switches at the top and bottom of stairs, and at the entrance to the bedroom and by the bed.

Keep pets out from under your feet.

Have a solid hand rail or banister on both sides of the stairs and ensure stair carpets or runners are well fastened.

In the bathroom, have a non-slip surface or bathmat in the shower and bath.

Install grab bars by the toilet, shower and bath.

Have a bath seat to enable showering while sitting if you tire while standing.

Place pots, pans, canned, goods and frequently used items in easy to reach locations.

Have a phone near the bed.

Keep a clear path from the bed to the bathroom and have a night-light to illuminate the path if you get up during the night.

Don't get up from bed too fast: sit on the edge of the bed for a minute so you don't experience dizziness.

(B.C. Health Files # 78, January 2001)

Cohort, leading to a 41 per cent reduction in risk of hip fracture (Feskanich et al., 2002) – therefore it appears walking is a simple activity that most seniors should be encouraged to do.

Exercise interventions must be developed and adopted with careful consideration to the individual's abilities because optimal levels of intensity are unclear and some programs may actually increase the risk of falls. More research is also needed on the benefits of activities such as line dancing, ballroom dancing, exercise with music, or other recreational activities that may provide exercise benefits but may also be more fun and attractive to seniors.

ENVIRONMENTAL MODIFICATIONS

Removing environmental hazards from the home was the focus of at least four randomized controlled studies accepted by all three systematic reviews. The hazards that were targeted included removing clutter, securing rugs and electrical cords, improving illumination, and installing hand-rails, grab bars and non skid strips.

According to the Canadian Best Practices Guide, an important aspect of successful home modification is to ensure that identified hazards are actually changed. Programs that not only had individuals going into senior's homes to conduct environmental assessments but that also made the necessary repairs or modifications were more successful than programs that simply identified the hazards and left it to the seniors to make the necessary modifications (Scott et al., 2001).

The Cochrane Review also reports that home hazard assessment and modifications is likely to be beneficial, if professionally prescribed (by a trained occupational therapist) to older people with a history of falling. There is less evidence of benefit of home hazard modification for elderly people without a history of falling (Gillespie, 2001).

The RAND systematic review concludes that environmental modification is probably an effective adjunct to clinical assessment and exercise intervention.

The Canadian Best Practices Guide concludes that the research evidence suggests the following:

- Home modification can be an effective strategy for reducing falls among seniors.
- To enhance the effect of home modification, it should be combined with education and counseling about reducing the risks, especially other risks that combine with environmental factors to increase the chance of falls.
- The most successful home modifications have a financial or manual assistance aspect of the program that gives real help to the senior in making home changes.
- The skills and training of occupational therapists make them ideal professionals to conduct home assessments, being able to evaluate both the senior's environment and his or her ability to function in that environment.
- Environmental modification is most successful and cost effective when targeted at people who are ready to change. Readiness is often a function of having had a recent fall or an increased understanding of fall risks.

ENVIRONMENTAL MODIFICATIONS TO PUBLIC SPACE

Research evidence for the effectiveness of modifying public space is not as ample as that for modifying home environments. Yet this could be a very fruitful area for future research into prevention programs.

A study by University of Victoria researchers found that 65 per cent of falls among seniors occurred outdoors while walking on a familiar route (Gallagher & Brunt, 1996). Another study found that 51 per cent of falls among active, healthy adults occurred outside the home (Reinsch et al., 1992).

Neither the RAND review nor the Cochrane review was able to find enough evidence to either support or discount the effectiveness of environmental modification outside the home.

The Canadian Best Practices Guide notes that it is difficult to evaluate interventions outside the home because of the numerous confounding parameters (uneven pavement, traffic noise, crowds, obstacles etc.), which make it difficult to discern whether a specific prevention activity made a difference. As well, environmental modification in public spaces involves a number of groups and individuals, including city planners, engineers and maintenance workers, government officials and transportation officials, making it more complex to design, implement and evaluate a program.

Local governments are often reluctant to acknowledge the existence of pedestrian trip hazards, due to liability issues. There is no evidence, however, of increased liabilities for municipalities taking a proactive approach to injury prevention. For example, in cities such as Kingston, Ontario, a local initiative promoted the sensible approach of spray painting sidewalk cracks with fluorescent paint in advance of repair, thereby helping seniors with poor vision to see and avoid the hazard.

Building codes for private dwellings in Canada are inadequate, especially in the design of safe stairways. According to stair expert, Jake Pauls, the basic rule of a maximum of 7 inches for the stair rise and a minimum of 11 inches for the stair tread is necessary for the safe use of stairs by all users. However, most Canadian building codes do not required this 7/11 standard and there is resistance from the building industry toward changing the code. In addition, codes are only reviewed every five years and unless there is compelling evidence, the tradition is to maintain the status quo.

Despite these challenges, it is clear that more research and work needs to be done to design and implement effective prevention programs to remove hazards that increase the risk of falls in our streets and public spaces.

FALLS HOTLINE IDENTIFIED HOT SPOTS

A unique B.C. program, STEPS (Study to Promote Environmental Safety) in the 1990s brought together seniors groups, government officials, city maintenance workers, politicians, health providers, building owners and others to look at ways to reduce fall hazards in public spaces. A telephone hotline was sponsored so that people could report falls or hazards, leading to the repair of some hazards or spray-painting a hazard such as a sidewalk crack with fluorescent paint in advance of it being repaired. Recommendations from a STEPS symposium included developing a clear mechanism for reporting hazards and then prioritizing their repair or removal.

(Gallagher & Scott, 1997; Gallagher, Scott & Mills, 1999).

EDUCATION

Education is an important component of most successful falls prevention strategies. Safety promotion – the first step in the continuum of injury prevention activities – involves raising awareness about the importance of preventing specific injuries such as falls. It also involves changing public values so that people no longer see falls among the elderly as an "accident" that cannot be prevented, and instead understand that falls are highly predictable events that can be minimized by taking specific preventive actions.

Evaluations of education strategies alone, however, are inconclusive. The Cochrane and RAND reviews both conclude that there is insufficient evidence to either support or refute education programs alone in terms of changing behaviours or reducing falling risk among seniors.

The Canadian Best Practices Guide concludes that education strategies may play an important role for seniors as part of a multi-faceted prevention program, by helping them become aware and concerned about the risks of falls, which may then increase their readiness to adopt one or more strategies to reduce falls (Scott et al., 2001).

Effective education may take many forms, including printed materials as handouts, discussion groups or the use of the media. Trained peer volunteers are well received by other seniors as reliable sources of information. Timing is also an important aspect of effective education programs. A senior who has had a recent fall is more likely to be receptive to learning about prevention than someone who has never fallen.

There is a need for research on the benefits of educating those who work with or assist the elderly regarding falls risks and prevention. Evaluation is needed to see if education programs that target nurses, physicians, long-term care staff, home support workers and the families and caregivers of the elderly are effective methods to reduce falls.

MEDICATION MODIFICATION

Numerous studies, including the analysis of B.C. PharmaCare data discussed in section 3 of this report, have shown the strong association between the use of certain medications – particularly anti-infectives, tranquillizers, sleeping pills, anti-anxiety drugs, tricyclic antidepressants and neuroleptics – and an increase in the incidence of fall-related injuries. For some of these drugs, the underlying condition for which they are taking the drug is likely contributing to the fall risk. For other drugs, it is drug-induced side effects that create the risk, or a combination of the side effects and underlying condition.

Once a senior is taking psychotropic medication and has become dependent on it for sleep or relaxation, withdrawal of the medication can be very difficult. Sleep problems can be exacerbated, creating a drug-induced insomnia. It usually takes the concerted effort of the patient, doctor and pharmacist to reduce the reliance on the medication. More effort must be made to ensure that fewer elderly patients are prescribed these drugs in the first place (see box on page 58).

While the theory of psychotropic drug withdrawal as a way to reduce falls is well known, only one randomized placebo controlled trial exists to test the theory. Campbell et al. (1999) assigned elderly patients taking psychotropic drugs to one of four groups: gradual drug withdrawal program only; gradual drug withdrawal plus a moderate exercise program; exercise program only; and a control group of no drug withdrawal and no exercise program. Although the sample size was small, the groups that underwent gradual drug withdrawal had a significant reduction in falls (66 per cent). The authors noted, however, that many of the participants were reluctant to stop psychotropic drugs permanently – only 17 of 48 participants in

PREVENTING SLEEP PROBLEMS IN THE ELDERLY

As people age, their sleep patterns naturally change, which can lead to complaints of light sleep, frequent awakenings, and daytime fatigue. These sleep changes are normal but more than half of elderly people who complain to their doctors about poor sleep end up with a prescription for a sleeping pill (Vitiello, 1997). The largest users of benzodiazepines – a class of drugs that include most sleep enhancing medications – in B.C. are people over the age of 65 (Scott, 2000). These medications are addictive and can have serious side effects, such as mental confusion, lack of coordination and increased risks of falls. Ways to alleviate sleep problems without the use of drugs should be promoted:

- Good sleep routines: Establish a regular bedtime, develop pre-sleep rituals, get up if you are not sleepy, avoid watching TV in bed.
- Healthy habits: Get exercise and some fresh air each day, avoid smoking, and alcohol before bedtime, eliminate caffeine from noon onward.
- Non-drug relaxants: A warm bath before bed, meditation or relaxation breathing, a small snack with cheese or a calcium/magnesium supplement before bed time – all can promote sleep.
- Review all medications: A pharmacist or doctor can help determine if some medications contribute to wakefulness and should be taken at a different time of day (Ancoli-Israel, 1996).

the drug withdrawal group complied with the full 30 weeks of the trial. Of those 17, eight started taking psychotropic drugs again within one month of completion of the study. More research is needed, including a larger trial, to further investigate effects of psychotropic drug withdrawal and delineate the practical aspects of obtaining compliance from elderly people to achieve this strategy.

The Canadian Best Practices Guide, as well as the Cochrane and RAND reviews, all use this one study to conclude prevention programs featuring withdrawal from psychotropic medication would likely be beneficial.

In light of the new B.C. research from the PharmaCare database that links numerous medications and combinations of medications with greatly increased risks of falls, it is clear more research is needed into effective strategies to modify drug use. For now, targeted warnings to seniors taking these drugs are needed, to alert them to the heightened risk of falls. Drug profiles can also be used to detect health problems that are associated with an increased risk of falling. Examples include drugs taken to treat acute infections, such as lung and bladder infections. Drugs taken to treat diabetes and cardiac disease are also more highly associated with a risk of falling, pointing to the role of these chronic conditions in increasing the risk of falling.

A second, alternative approach to drug modification is to give drugs to the elderly that ostensibly build bone mass, treat osteoporosis (see box) and reduce the chance of a fracture during a fall.

OSTEOPOROSIS

Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue. This leads to increased bone fragility and a higher risk of fracture, particularly of the hip, spine and wrist, after a fall or minor trauma.

Risk factors for osteoporosis include a confirmed fragility fracture or vertebral compression fracture, low bone density, age over 65, and a family history of osteoporosis. Other risk factors include a history of smoking, excessive alcohol intake, low calcium intake, early menopause, and some disease processes such as primary hyperparathyroidism and long-term use of steroid medication such as prednisone. Mechanisms likely to be involved in bone loss in older people include a lack of exercise, low dietary intakes of calcium and vitamin D, as well as lack of sun exposure.

Screening symptom-less patients with bone mineral density (BMD) testing is controversial. Currently, the B.C. Medical Services Plan only pays for BMD when risk factors other than age alone are present and the outcome of the test is needed to guide treatment decisions. The rationale is that many individuals with low bone density do not progress to fracture and many with normal bone densities still suffer from fractures, which would lead to either over-treatment or false assurance.

Over-reliance on BMD testing may also detract from other important, proven interventions such as diet, exercise and proven fall prevention strategies. All seniors should ensure they have an adequate intake of calcium (1500 mg/day) and vitamin D (800IU/day), continue to do weight bearing exercise and spend some time in the sun.

For those with confirmed osteoporosis, along with calcium and vitamin D, some new drugs have been approved to increase the bone mineral density (BMD). Most of the drugs work by inhibiting bone reabsorption but side effects can be severe for some people, including eosophageal erosion and other digestive complications. The drugs include the bisphosphonates (alendronate and risedronate), which have been shown to increase BMD and reduce hip fracture in those with confirmed osteoporosis (Black et al., 1996; Cummings et al., 1985; Harris, et al., 1999; McClung et al., 2001). The drugs calcitonin and raloxifene have both been shown to reduce the rate of vertebral fractures but so far there is insufficient evidence to indicate either drugs' effectiveness in reducing other fractures (Cummings et al., 1990).

One study examined giving oral hormone replacement therapy (HRT) plus calcium, versus calcium alone, to women who had sustained a wrist fracture in the previous seven weeks (Armstrong et al., 1996) but no benefit was found.

With the more recent Women's Health Initiative – which featured a double blind randomized controlled trial of HRT among 16,000 postmenopausal women, showing an increased risk of cardiovascular disease and breast cancer (Rossouw et al., 2002) – it is unlikely that HRT will receive further support as a method of reducing potential bone fractures.

The biological mechanisms most likely associated with bone loss in seniors are a lack of exercise, dietary calcium, vitamin D, and sun exposure. Vitamin D and calcium supplements have been shown to reduce both falls and fractures among older adults. The protective effect may be a combination of moderate bone density enhancement combined with increased muscle strength that improves function and reduces the risk of a fall. For those at risk for osteoporosis, bone-enhancing medications such as alendronate or risedronate may decrease their risk of sustaining a fall-related fracture.

Black et al. (1996), in a randomized trail with 2,027 women with low bone mineral density and existing vertebral fractures, the use of bisphosphonate alendronate compare to a placebo over 36 months resulted in 8 per cent new vertebral fractures among the group taking alendronate and 15 per cent among the placebo group. A more recent study (McClung et al., 2001) has shown a reduction of hip fractures with risedronate – another bisphosphonate drug designed to enhance bone mineral density. Among 9,331 women with diagnosed osteoporosis, randomly assigned to treatment or control groups and tracked over three years, 2.8 per cent of those on risedronate sustained a hip fracture compared to 3.9 per cent of those taking placebos.

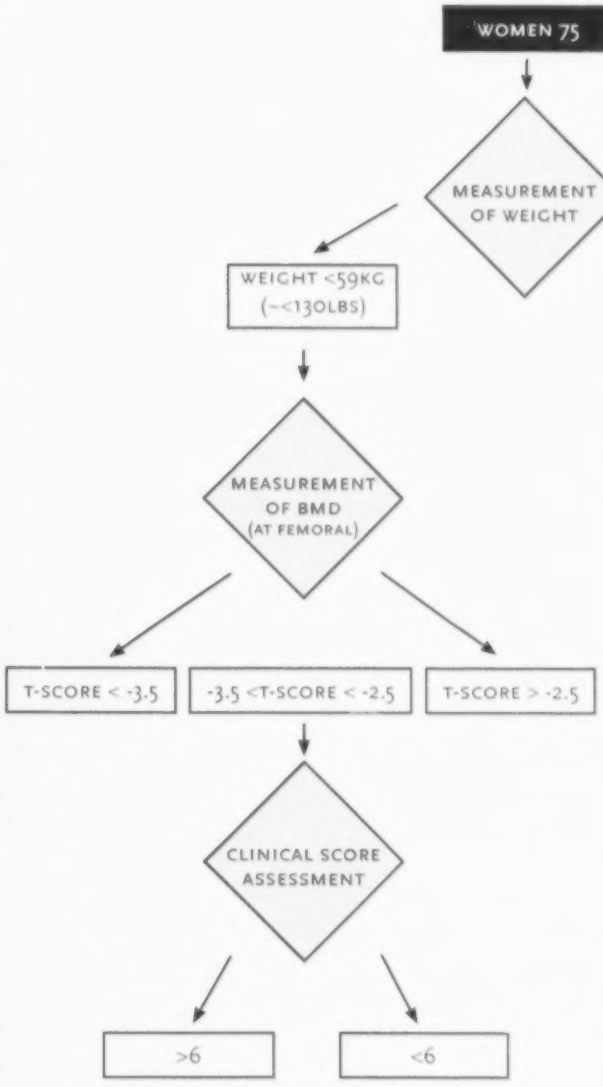
The findings of the study using vitamin D3 plus calcium showed that among 1,634 women receiving the supplements there were 43 per cent fewer hip fractures and 32 per cent fewer vertebral fractures over 18 months compared to group receiving placebos (Chapuy, 1992). Another study conducted over only three-months with 122 elderly women testing calcium plus vitamin D compared to calcium alone, showed a reduction in the risk of falling by 49 per cent for the calcium plus vitamin D group compared to those taking calcium alone (Bischoff et al., 2003). However, the sample size was small and this study bears repeating with a larger sample over a longer time. An adequately large sample size is even more important when the outcome measure is a rare event, such as a fracture to the hip.

PREVENTING FRACTURES IN ELDERLY PEOPLE

A recent clinical review (Woolf et al., 2003) provides a comprehensive guide to clinicians for the prevention of fractures in the elderly. It summarizes the risk factors, current recommended pharmacological interventions (combined calcium and vitamin D, and the bisphosphonate drugs) and outlines clinical assessment guidelines for physicians. The review points to the evidence that a sedentary lifestyle, poor diet, smoking, and alcohol misuse are detrimental to bone health and the importance of influencing the modification of these factors.

One of the most devastating consequences of a fall is a hip fracture. Recent research (Dargent-Molina et al., 2002) recommends the use of a fracture risk screening tool to assist in targeting those at greatest

FACTORS THAT DETERMINE HIP FRACTURE RISK AMONG WOMEN
(Algorithm developed from the EPIDOS study, Dargent-Molina et al., 2002)



CLINICAL SCORE ASSESSMENT		
FACTOR	VALUE	WEIGHT
Age	75 yrs (ref)	0
	76-79	1
	80-84	2
	>85	3
History falling in prior 6 months	No (ref)	0
	Yes	1
Tandem walk	Able without trial (ref)	0
	Able after trials	0
	Unable (or not performed)	2
Gait Speed	> 1.4 m/s (ref)	0
	1.0-1.4 m/s	1
	0.6-1.0 m/s	2
	< 0.6 m/s	3

Women at 2 times the average risk for hip fracture are:

- **T-score (at femoral neck) ≤ -3.5 OR**
- **T-score between –3.5 and –2.5 (at femoral neck) AND clinical score greater than 6**

risk of sustaining a hip fracture. The study described below aimed to develop a screening tool appropriate for use in the clinical environment (i.e. physician's office) to help physicians identify those women who are at two times greater risk of sustaining a hip fracture. If women who are at higher risk can be identified, then they can be treated appropriately for their bone health and their risk factors for falling.

A UNIVERSITY OF BRITISH COLUMBIA HOSPITAL (UBC) HIP FRACTURE PROGRAM

Patients who suffer hip fractures are at risk for numerous predictable problems that delay recovery and result in added morbidity, mortality and functional decline, among them, osteoporosis and falls. Almost all older patients admitted with hip fractures have fallen and have osteoporosis. Historically, these problems were not systematically managed in acute care, with the goal of preventing fractures and readmissions.

At UBC Hospital the Hip Fracture Program uses a "Care Mapping" approach titled the Vancouver Model for Accountable Care (VMAC), so that predictable problems were anticipated, prevented, screened for and managed using the best available evidence.

The new program includes:

1) A preprinted physician's admission history that prompts investigation of circumstances and underlying causes of the fall, history of osteoporosis and falls and related treatment.
2) Preprinted physician's orders that prescribe calcium and vitamin D, according to current best evidence based practice.
3) A clinical path guiding nursing, occupational therapy and physiotherapy regarding assessments, exercises and teaching for falls and fracture prevention.
4) Patient and family teaching and education materials for falls prevention, nutrition and osteoporosis.
5) Transfer summary to family physicians.

Evaluation of the Hip Fracture program is in progress. It is hoped that this systematic approach will result in fewer readmissions for falls and fractures in this patient population.

The *Epidemiologie de l'ostéoporose* (EPIDOS) is a study of 7,575 women aged 75 years and older in France. These women were followed for up to four years, to observe which women experienced a hip fracture and which women did not. The overall aim of the EPIDOS study was to determine the factors that were best able to predict hip fracture – both those related to bone (bone mineral density at the femoral neck) and those related to the risk of falling. The particular objective of this study was to calculate an individual risk score for hip fracture based on each woman's personal characteristics, and to identify a high risk group – that is, those women with a higher than average risk of hip fracture. Using this screening tool, the results indicated women who have two times greater risk of sustaining a hip fracture are those who:

- Weigh less than 130 lbs, and have a bone mineral density (BMD) T-score of less than –3.5 at the femoral neck.

(The T-score compares the individual's BMD score to that of a population of normal young adult women.)

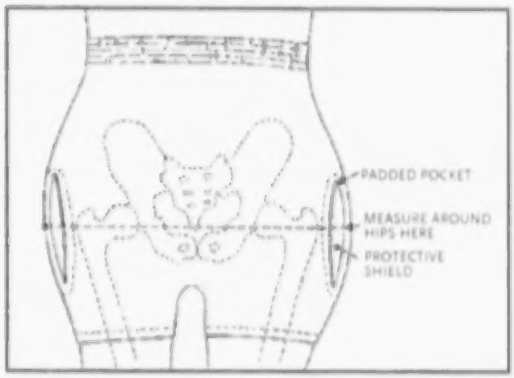
OR

- Weigh less than 130 lbs, have a BMD between –3.5 and –2.5 at the femoral neck and have a clinical score greater than 6 points.

The clinical score (see box on page 61) was based on age, history of falling in previous 6 months, tandem walk (ability to do 4 consecutive steps "heel to toe") and gait speed (time to walk a 6 meter course).

Although this study provides a starting point for screening women who are at particularly high risk for hip fracture, it has limitations. The authors themselves identify the fact that the results of this study are from a volunteer population, the majority of whom lived independently at home. Therefore, the screening tool may not be appropriate for less mobile, less healthy elderly women. As well, this study involved women aged 75 years and older and therefore the results may not apply to a younger population.

HIP PROTECTORS



One of the newest approaches to lessening the impact of falls is to protect the most vulnerable spot of the body should a fall occur – the hip.

A wide variety of hip-protectors are now on the market, most of which feature a plastic or foam oval shaped shield that covers the hip area. Worn over the hip in a pair of undergarments or exercise shorts, the shield absorbs the impact of a fall or disperses the energy of the fall over a wider area, therefore decreasing the likelihood of a bone fracture. Most early research has been conducted in Scandinavian countries, where the protectors were developed, but newer studies are emerging from Japan, the United Kingdom, New Zealand and Australia.

In the spring of 2002, the Cochrane Collaboration conducted a review of seven randomized controlled or quasi-randomized controlled trials of hip protector benefits (Parker et al., 2002). The review encompassed a total of 3,553 high-risk individuals living in nursing homes or frail elderly living at home. The Cochrane analysis indicated that different designs and models of hip protectors used in the studies were likely to be equally effective. However, new devices are coming on the market and until those have had their effectiveness proven by a randomized

HIP PROTECTORS AND COMMUNITY-LIVING SENIORS: A REVIEW OF THE LITERATURE

A new review of the use of hip protectors by community-living seniors will soon be posted on the Health Canada and BCIRPU Web sites.

This review covers the literature regarding the efficacy of hip protectors for community-living older adults. It summarizes the methods used to uncover research and provides and overview of the prevalence and cost of hip fractures. It gives an overview of the relationship between falls and hip fractures, and some indication of who, among community-living seniors, may be at highest risk for hip fractures. It explores the benefits of hip protectors for community-living older adults and issuess related to compliance. The review concludes with recommendations for the prescription and promotion of hip protectors among community-living older adults and suggestions for future research.

control trial, it cannot be assumed that all hip protectors will be equal. More evidence is needed as to whether soft shell products provide the same benefits as hard-shell products. Doctors and staff at long-term care institutions should only recommend those products that have been proven (Rosenberg, 2003; Kannus et al., 2003).

However, the Cochrane analysis, as well as other studies, has found that compliance with the devices is poor. Some elderly participants find them hot, uncomfortable and difficult to pull on and off, particularly when toileting frequently. Cost is also an issue for some seniors. A recent study in the British Medical Journal found that free provision of hip protectors increases their use among the elderly (Meyer et al., 2003).

Researchers in British Columbia, Drs. Sonia Singh, Aslam Anis and Huiying Sun, modeled the cost-effectiveness of hip protectors in preventing hip fractures, compared to no treatment, and to calcium and vitamin D. This was done using a hypothetical cohort of 1,000 nursing home patients (Singh, S., June 7, 2003). Data regarding costs, effectiveness and quality of life measures were collected from the current literature and from Peace Arch Hospital, a community hospital in White Rock, British Columbia. A societal perspective was adopted for the study. The results of the study suggest that treating 1,000 nursing home residents for

A SIMPLE TEST: RISING FROM A CHAIR

Researchers have found a strong correlation between the difficulty in rising from a chair and walking a short distance and the risk of falling (Mathias et al., 1986; Podsiadlo et al., 1991). The simple "Timed get up and go" test measures the time it takes for a senior to rise from a chair and walk a few meters and back across a room. The longer time it takes or the more unsteadiness, the greater the risk of falling.

A simple screen such as this can be easily incorporated into a short doctor's visit, notes Dr. Mary Tinetti in a recent review article in The New England Journal of Medicine (Tinetti, 2003).

one year would prevent 27 fractures from occurring, at a net cost saving to society of $270,000. Quality of life assessment also showed significant cost saving, with a cost per quality adjusted life year gained of approximately $10,000. Compared to calcium and vitamin D, hip protectors were also found to be cost saving, provided the cost of a hip protector stayed below $150 and no extra nursing time was required to put on the hip protector. The results of this study suggest that hip protectors may also be cost-effective when used among those people at high risk of falling who are still living independently at home. With the low unit cost of $150, hip protectors may save money while preventing fractures, prolonging life and improving quality of life in elderly nursing home patients.

If hip protectors can be made more comfortable and easy to use, they may be a simple and cost effective way to reduce one of the most dangerous and feared consequences of falling – breaking a hip.

CLINICAL INTERVENTIONS

Clinical intervention for falls prevention is primarily based on doing a systematic assessment of an individual by a health practitioner, where the purpose of the assessment is to identify and lessen physiological and psychological factors found to contribute to the risk of falling or sustaining a fall-related injury. Many of the factors identified in a careful evaluation may be amenable to treatment, which could then reduce the likelihood of a fall.

According to the American Geriatric Society (as reported in the RAND review), a falls assessment or evaluation should include: a history of fall circumstances, medications, acute or chronic medical problems, and mobility levels; an examination of vision, gait and balance, and lower extremity joint function; an examination of basic neurological function, including mental status, muscle strength, lower extremity peripheral nerves, proprioception, reflexes, test of cortical and cerebellar function; and extrapyramidal assessment of basic cardiovascular status including heart rate and rhythm, postural pulse and blood pressure, and if appropriate, heart rate and blood pressure responses to carotid sinus stimulation.

The results of this assessment may then require referral to appropriate specialists, such as a neurologist or geriatrician, or to other health professionals to deal with issues such as the need for assistive devices, home modifications, exercise and diet regimes, and other interventions that could reduce the chance of a subsequent fall (RAND Report, 2003).

Other non-medical assessments may help in identifying seniors at risk and assist in making appropriate referrals for follow-up intervention. One RCT study had volunteers administer a questionnaire to seniors about their ability to perform the activities of daily living, followed by regular visits or referrals to health practitioners (Carpenter et al., 1990). It found the intervention group had a significant reduction in falls compared to the control group.

The RAND Review concluded that research evidence supports a focused falls risk assessment with follow-up as the most effective component of a falls prevention program, along with standardized data collection for recording fall incidents.

The Canadian Best Practices Guide came to the same conclusion following a review of the literature and found that clinical assessments proved useful in a variety of settings, and administered by a variety of professionals or trained volunteers. Clinical assessments could be implemented by emergency room nurses and doctors (Baraff et al., 1999; Close et al., 1999), in health centres by either

doctors or nurses (Wagner et al., 1994) and in the senior's home either by trained health professionals (Gallagher & Brunt, 1996; Fabacher et al., 1994; Weber et al., 1996) or by trained volunteers (Carpenter et al., 1990; Vetter et al., 1992).

The Canadian Best Practices Guide noted that it was particularly important to do an in-depth assessment following a fall in order to uncover undiagnosed health problems that may contribute to the risk of further falls.

Laurence Rubenstein and colleagues, under the auspices of RAND's Assessing the Care of Vulnerable Elders (ACOVE) project, have conducted a literature review regarding potential quality indicators for falls and mobility disorders. Rubenstein and colleagues have created an algorithm that links detection, evaluation, and intervention and shows the relationship of each of the indicators to the overall diagnosis and management (Rubenstein et al., 2001). Physicians should initially screen their elderly patients with two simple questions: "Have they had a fall?" "Are they experiencing mobility problems?" If the patient reports no problems, there is no need for further intervention. If the patient reports more than two falls, he or she should undergo a fall risk assessment which would examine home hazards, gait and mobility problems, polypharmacy and other medical problems. If the patient reports mobility difficulties, he or she should have a gait and mobility evaluation that looks at balance, strength and endurance, vision problems, pain and joint problems, and sensory problems. The problem is then either treated or the patient is referred to appropriate programs or specialists, such as an exercise program or ophthalmologist. The schematic for Rubenstein's algorithm for physicians is detailed in Appendix D.

Some fall risk assessment tools have been tested for reliability and published. A list of validated assessment tools can be found on the B.C. Injury Research and Prevention Unit web site at www.injuryresearch.bc.ca. Other tools are being developed, such as one now undergoing study in British Columbia, Ontario and Nova Scotia in long-term care facilities. A variation of this tool is also being tested among community seniors who receive home support services in B.C. (See Section 5 of this report, for more information about this and other new studies.)

Clinical assessment is seen to be a promising avenue for dealing with falls in the community, but there is less evidence so far of its effectiveness among seniors in long-term care institutes. Some of the recurring questions about how to conduct clinical assessments in long-term care homes include the following:

- **Who does it?** – Should the assessment be carried out by a referral to a doctor? Can nurses or therapists in the facility conduct the assessment? Or is the best approach to have components of the assessment conducted by different members of a multidisciplinary team?
- **Who is assessed?** – All new residents? Only those identified at being high risk for falls, or all residents who have a fall?
- **How often is it done?** – When should that information be updated? Should it be updated at regular intervals or only when there is a clear change in the patient's physical or cognitive abilities?

Research is underway in B.C. to help answer some of these questions, as detailed in Section 5 of this report.

MULTIFACTORIAL INTERVENTIONS

Falls are often the result of a complex, interdependent constellation of factors in which multiple causes interact together to produce a fall. For that reason, interventions that address a number of factors at once not only make sense but have been shown in the research evidence to be most effective.

Most multifactorial interventions begin with a thorough clinical assessment of the individual senior's risk factors for falling and then the implementation of interventions based on these assessments, to deal with the medical management of problems, medication risk, behaviour, home modifications, and education.

The RAND Review (2002) concluded that multifactorial interventions that start with a focused clinical assessment followed by appropriate interventions are the prevention strategies that have the greatest support in the research literature.

The Canadian Best Practices Guide (Scott et al., 2001) reviewed seven multifactorial studies and found evidence for their effectiveness. One randomized controlled trial by Tinetti et al. (1994) used nurse practitioners and a physical therapist to conduct in-home base-line assessments of physical, behavioural and environmental risk factors for falling. Based on the assessments, the participants received three months of focused interventions – dealing with everything from learning transfer skills in the bathroom, medication reviews, treatment of medical problems, home hazard removal, gait training and exercises to promote strength and balance. The group that received the intervention had significantly fewer people who fell (35 per cent intervention versus 47 per cent control) and had a significantly fewer number of falls (94 versus 164).

The Cochrane review also concluded from the available research evidence that prevention strategies were likely to be beneficial if they included multidisciplinary, multifactorial screening and assessment of health and environmental risk factors, followed by appropriate interventions. Screening plus intervention was likely to work equally well for the general population of community-dwelling seniors, for older people with a history of falling, or for people selected because of known risk factors (Gillespie et al., 2001).

MULTIFACTORAL INTERVENTIONS IN EDMONTON

A symposium was held in March 2002 in Edmonton: "Taking the right step forward: Preventing falls in the Capital Region" (Predy et al., 2002). A total of 121 participants from multiple disciplines came together to address falls in youth and older adults. For the older adults, strategies were suggested for Home Dwelling, Supportive Housing, Continuing Care and Acute Care and Rehabilitation. The participants noted that efforts towards fall prevention must include the following: improved awareness of falls and falls prevention; improved and comprehensive data collection and surveillance systems; more collaboration and multi-stakeholder partnerships; and comprehensive consideration of the four "E's" of injury prevention: education, engineering, enforcement, and evaluation and research. For older adults, medication use and the need for a regional risk assessment tool were priority issues for action.

5. Research Needs and Promising New Areas

In this report, it has been firmly established that falls among the elderly exert a significant burden of injury in B.C. In addition, there are recognizable risk factors that can help identify those elderly individuals most susceptible to falling and sustaining an injury, and that there is a growing body of research evidence for effective strategies to reduce falls.

However, there is a clear need for more research or initiatives, particularly in the following areas:

- **Exercise:** Is one type of exercise more effective than others? Which exercises are best for seniors with chronic health conditions or disabilities? How much exercise is enough, and what is the best way to motivate seniors to maintain their health and mobility in this way? Research is needed to understand and address the barriers to exercise. Research should also test the cost-effectiveness of delivering home-based exercise.
- **Hip protectors:** More research studies on hip protectors should be undertaken to evaluate their effectiveness in the B.C conext, including research on issues of compliance and cost effectiveness.
- **Environmental modification:** Spray painting sidewalk cracks and exposed tree routes in public spaces seems a promising intervention to alert seniors with poor vision to potential trips hazards. Research is needed, however, to convince municipalities of the benefits of this strategy and alleviate fears of increased liability. Two matched communities with similar percentages of elderly citizens could be studied, for example, by comparing the rates of falls in one community that spray-paints cracks versus a community that does not do so. Other environmental strategies, both for the home and the community, need to be investigated to see if they reduce the risk of falls. Particular attention is needed to the study of interventions along streets and walking routes frequented by seniors, such as from a bus stop to the doctor's office, or between a seniors' complex and the local store.
- **Psychotropic drug use:** While it has become accepted as fact that use of certain drugs, such as benzodiazepines, tranquillizers, anxiolytics etc., can increase the risk of falls, only one randomized control trial exists where an attempt was made to end seniors' use of these drugs. More research is needed, including a larger trial, to further investigate effects of psychotropic drug withdrawal and delineate the practical aspects of obtaining compliance from elderly people to achieve this strategy. More research also is needed into effective strategies to modify drug use or provide targeted warnings to seniors taking these drugs, in order to alert them to the heightened risk of falls. Also, there has been very little research on the contribution that alcohol makes towards the incidence of falls and injuries in the elderly.
- **Medication warnings:** The analysis of aggregate PharmaCare data has revealed an association between certain drugs (and, by implication, related medical conditions) with a significantly increased risk of falling, particularly with drugs used to treat infections, diabetes and heart disease. More research is needed, however, to

determine if the rate of falls among this population can be reduced by placing warnings on certain drugs, or by providing fall prevention tips to those elderly persons who are prescribed certain drugs, or who are diagnosed with certain conditions.

- **Falls in acute care hospitals and following discharge:** More research needs to be done to assess the incidence rate of falls occurring in hospitals. Research is also needed in order to address knowledge gaps regarding the factors that contribute to falls in acute care settings. In addition, research is needed regarding falls that occur shortly after discharge from hospital; this research should determine the best practices for assessing people at high risk for falling during or after an acute illness or extensive bed rest and identify strategies for best reducing these risks.
- **Long-term care institutions**: A standard method for recording falls and fall-related injuries in British Columbia's long-term care facilities needs to be established: this will enable better data collection and an enhanced ability to both apply and evaluate fall prevention strategies in the long-term care setting. In addition, we need to be able to compare numbers over time and across institutions.
- **In depth falls assessment:** Research evidence has shown that a thorough, focused falls assessment followed by a targeted intervention program that reduces prominent risk factors is among the most successful type of fall prevention strategy. However, it is not yet clear who should be responsible for conducting this assessment. Many interventions have used physicians, but other professionals – such as nurses, physiotherapists, occupational therapists and community health care workers – may be equally able to assess risk factors and refer the elderly client onto appropriate services.

  A randomized control trial is needed to compare the effectiveness of falls risk assessment tools.
- **Cost benefit studies:** Participants at the PHO's regional workshops for the development of this report identified the importance of cost benefit studies to support and justify, where appropriate, interventions to prevent falls and injuries in the elderly.

Some questions remain: How to encourage physicians, who may be feeling overworked, to incorporate falls risk assessment into their routine of care for elderly patients? Who else would be equally effective in assessing risk and targeting prevention strategies?

Another promising area needing more research is the creation of specialized falls clinics targeted to elderly people at risk. Can these clinics provide a model that can be effectively used in some locations in the province? Perhaps falls clinics could be linked with hospital emergency departments to provide in depth falls assessments of elderly who have been injured from falls, or of elderly in geriatric day care programs, day hospitals and other locations offering care to frail seniors.

NEW RESEARCH IN B.C.

British Columbia is fortunate enough to have a number of world-renowned falls researchers who are contributing to the knowledge and understanding of falls incidence, risk and prevention.

B.C. Injury Research and Prevention Unit (BCIRPU)

Through the BCIRPU, the province of B.C. is co-funding three new initiatives

in partnership with the regional health authorities; these initiatives will focus on fall assessment and prevention, particularly for seniors in long-term care and those seniors living in the community who require home support. Dr. Vicky Scott, of BCIRPU and the Ministry of Health Planning, Office of Injury Prevention, together with Dr. Elaine Gallagher at the University of Victoria and Dr. Mariana Brussoni of the BCIRPU, are collaborating with B.C. Health Authorities on three pilot projects to test assessment and training protocols for the prevention of falls in the following areas.

- **Project 1 - Surveillance:** How many falls occur in a typical long-term care home in B.C. and why do they occur? What are the characteristics of patients who have a tendency to fall and what happens to them? Are there design or management issues in the care home that influence or contribute to the number and outcome of falls? Drs. Scott, Gallagher and Brussoni, with two colleagues outside the province, are examining these and other questions in a study that will test a system for monitoring and preventing falls in long-term care homes in British Columbia. The study is also being conducted concurrently in Ontario and Nova Scotia. Data on the nature and severity of falls will be collected as a baseline to then evaluate subsequent fall prevention programs in those facilities. The study hopes to be able to recommend a standardized, systematic surveillance system for long-term care homes that will help B.C. track and address the factors contributing to falls in institutionalized populations.
- **Project 2 - Community Health Worker Training:** For frail elderly individuals living at home, the community health worker who comes in to provide personal assistance with the activities of daily living often has the most contact and opportunity to assess the client and the living environment for the risk of falls. Can these individuals be trained in falls risk assessment and the best practices of falls prevention, in order to help reduce the number of falls and related injuries among frail seniors living in the community? A new study directed by Dr. Scott is developing and pilot testing a training module for community health care workers around the province. The study's objectives are to:
  - establish priorities and practices for the training of community health workers through consultation with a steering committee of key stakeholders;
  - design and test a best practices training module for falls prevention based on a synthesis of current literature;
  - pilot test the module in a training workshop, and;
  - implement and monitor the effectiveness of the module in reducing risk factors and falls over a period of six months.
- **Project 3 – Clinical Falls Assessment Tool:** Guidelines are being developed for clinicians to use to assess seniors at high risk for falling and to recommend steps for prevention. These are still in the planning stages.

University of B.C.

Research has found that more than 350 women age 70 and older visit Vancouver Hospital Emergency Department with fall-related injuries every year. Since this group is at high risk of further injury, researchers from the University of B.C. lead by Dr. Karim Khan and Dr. Heather McKay, have implemented a pilot "Falls Research Clinic" to provide optimum care

to these people, based on the American Geriatrics Society Guidelines. The researchers have applied for funding to study the effectiveness and cost-benefit of such a clinic compared with usual clinical management. In addition, all participants receive a novel screening for fall risk (FallScreen) (Lord & Menz, 2003). It is hoped that this instrument will help to provide a simple office screening method to identify patients who require more advanced fall prevention intervention. The UBC-based researchers are also examining the clinical pathways that are offered to patients who present with wrist fractures and hip fractures, to see if their management matches current guidelines. If, as preliminary data suggest, these patients receive sub-optimal management, it would provide an opportunity for knowledge translation to reduce future injury after these initial fractures occur.

Simon Fraser University

The Injury Prevention and Mobility Laboratory at Simon Fraser University, under the direction of Dr. Stephen Robinovitch, assistant professor of kinesiology, is focused on developing improved methods for preventing falls and fall-related injuries. Safe experiments with human subjects are used in combination with mathematical models to assess how age-related declines in neuromuscular performance alter one's ability to prevent falls, and avoid injury in the event of a fall. Engineering tools are being used to develop and evaluate specific fracture prevention strategies, from exercise training to hip pads and energy-absorbing floors (for lessening impact force). The research lab is also examining the links between age-related changes in sensory-motor function, cognition, and balance, and the mechanics and prevention of forearm fractures from falls on the outstretched hand (the most common fracture in the under 65 population).

The results of these studies are eagerly awaited because of their potential application to larger numbers of the B.C. population.

NATIONAL INITIATIVES INCLUDE B.C. COMMUNITIES

Health Canada and Veterans Affairs Canada have established a community-based health promotion initiative to help identify effective strategies for preventing falls in the community among veterans and seniors. In 2000, Veterans Affairs Canada committed $10 million to be allocated over a four-year period for this health promotion initiative. The goal is to pilot approved projects in the regions and nationally and projects are to be completed by March of 2004.

The initiative recognizes that falls among the elderly have multiple facets that need to be addressed with strategies promoting the involvement of a diversity of sectors and players, including seniors and veterans themselves. The initiative provides funding to sustainable community-based projects aimed at enhancing the independence and quality of life of community-dwelling veterans and seniors by preventing falls and reducing their severity. Projects that were funded demonstrated active involvement by seniors and veterans, such as using participants as peer volunteers who are trained to help deliver the program to other seniors.

Five community-based projects are currently being funded in British Columbia. Highlights of the programs include:

- **Vernon:** This project is coordinated by the Social Planning Council for the North Okanagan, and includes veterans and local seniors, along with the regional health authority, municipal building and engineering departments, health providers and emergency

services. Interested seniors are trained as peer volunteers to increase awareness among seniors. Pharmacists and nurses will support a medication review. See their Web site at: http://www.spcno.bc.ca/seniors/falls

- **Prince George Region:** The Northern Health Authority coordinates a project that focuses on increasing awareness about fall risks among seniors and reducing environmental hazards in five northern communities. The multi-dimensional program, which

THE BC HEALTHGUIDE PROGRAM AND BC NURSELINE HELPS SENIORS BY PROVIDING HEALTH INFORMATION ON THE PREVENTION OF FALLS

The BC HealthGuide Program is a free self-care program for British Columbia residents. It is designed to help British Columbians to stay well, and to know when to seek help from a physician or other health care provider. The program has four components: the BC HealthGuide Handbook and First Nations Health Handbook; the BC HealthGuide OnLine Web Site: (www.bchealthguide.org); the BC NurseLine; and the BC HealthFiles.

The BC HealthGuide program provides reliable, current health information and professional nursing assistance to help citizens of all ages make wise health decisions. Seniors with chronic illness or who have suffered a fall with complications are especially encouraged to use the handbook, web site, or call a nurse to receive confidential health information and advice.

The BC HealthGuide Handbook and BC HealthGuide OnLine web site contain medically-reviewed information about symptoms, conditions and diseases, including helpful tips and tools on when to see a doctor, visit the emergency department, or safely try home treatment. The First Nations Health Handbook is a companion document to the BC HealthGuide Handbook that became available in Winter, 2003. Copies of either of these handbooks can be obtained by calling the Ministry of Health Information Line at 1-800-465-4911.

The BC NurseLine is staffed by specially trained registered nurses who are available to answer callers' questions 24 hours a day; if appropriate, callers may also be referred to other health and social services. Between 5 p.m. and 9 a.m., NurseLine nurses can also refer callers to a BC NurseLine pharmacist for answers to complex medication-related questions. To call the BC NurseLine, dial:

Greater Vancouver:	604-215-4700
Toll-Free elsewhere in B.C.:	1-866-215-4700
Deaf and Hearing Impaired toll-free:	1-866-889-4700

Service is available in 130 languages.

To request promotional materials or more information about the BC HealthGuide Program or any of its components, contact Lori Halls, Director, at 250-952-3207, or write to BC HealthGuide Program, 4th floor, 1515 Blanshard Street, Victoria, B.C. V8X 3C8.

involves veterans and seniors in the project design and delivery, includes a system for reporting and reducing environmental hazards in public places.

- **Burnaby/Ridge Meadows:** Delivered by the Fraser North Health Service, the project delivers a falls risk reduction program to veterans and seniors living in the two communities, through seniors' centers, housing complexes and outreach programs. Key program components include: educational workshops; forums to increase awareness and knowledge of risk factors, fall hazards and prevention strategies; fall risk assessments and the subsequent development of individualized fall reduction programs for participants; and peer and community support for interventions such as exercise programs and environmental changes. A social marketing/public awareness campaign is being conducted to complement and reinforce the overall strategy and encourage seniors to participate.
- **Vancouver:** Located at the 411 Seniors Centre Society in central Vancouver, the project is coordinated by a multi-stakeholder committee including representation from veterans, seniors' organizations, city social planning departments, community health professionals and ethno-cultural representatives. The project goal is to reduce fall risks in seniors and veterans in Vancouver by providing them with fall prevention information and support in order to enable them to make changes in personal health practices that contribute to falls. Senior and veteran volunteers are being recruited and trained to offer the program. Special efforts are directed to adapting materials and outreach strategies to ensure the participation of Chinese and Punjabi speaking seniors.
- **Victoria:** Sponsored by the Vancouver Island Health Authority, the project goals are: to reduce falls among seniors and veterans through a community development process and to develop, test, and share a falls prevention model that may be replicated in various settings and jurisdictions. The program is being developed and tested in seniors' housing complexes and veterans' clubs/day centers. Seniors are trained to deliver the strategy, with physiotherapists, occupational therapists, nurses, apartment managers, center activity workers, housing staff and home support workers also involved in the implementation of the action plans. A falls inquiry line and Web site have been created at: www.victoriafallsproject.com

INVOLVEMENT OF THE ELDERLY

Health Canada and Veterans Affairs Canada have recognized that it is essential to involve seniors themselves as key participants in the design and implementation of community-based strategies. And, although no randomized controlled trials have been conducted that support this approach, the Canadian Best Practices Guide made a point of highlighting what it called "promising community empowerment approaches" (Scott et al., 2001). Instead of featuring pre-designed programs delivered by health professionals in a "top-down" fashion to seniors who are passive recipients, community empowerment approaches involve the senior as an equal partner.

Other community partners who can help create a "bottom-up" approach to falls prevention include faith groups, advocacy groups, business people, educators, pharmacists, architects, urban planners, municipal engineers and local

government. Involving a wide range of community stakeholders has the advantage of increasing local acceptance and commitment to the project and encouraging the involvement of those seniors who do not wish to be seen as old, frail and vulnerable and in need of "help".

The results of the Health Canada and Veterans Affairs Canada programs will serve as an important measure of the effectiveness of this grass-roots community approach in terms of involving seniors in falls risk programs, raising awareness about falls risk, and reducing the incidence of falls and fall-related injuries.

ONGOING SURVEILLANCE

A commitment to the ongoing collection and sharing of relevant data is necessary in order to monitor the impact of falls among seniors in B.C. and to understand whether we are making progress ' reducing the incidence of falls and fall related injuries. Currently, the only consistent, province-wide sources of data in B.C. regarding fall injuries are those from hospital separation (hospital cases) and vital statistics (death) records. However, these sources only cover a fraction of the actual fall and fall-related injury events for seniors in the province.

The Emergency Department Injury Surveillance System (EDISS), now underway in 10 hospitals in B.C., is an important start to better understanding the nature and magnitude of the problem, particularly the pre-event circumstances that resulted in injuries. However, the funding for this pilot project may run out in 2004. This project needs to obtain permanent funding and consideration should be given to expansion to all B.C. emergency wards so we can better monitor and analyze the types and causes of injury in the province. One way to do this would be to adopt the National Ambulatory Care Reporting System (NACRS) in B.C., as is suggested in the attached recommendations. The data elements used in EDISS system would then be collected in a systematic manner that allows for provincial and national sharing of injury information.

There are other potential sources of surveillance data that can help us understand the magnitude of injuries from falls and other causes. These include:

- **B.C. Ambulance Service:** How many calls to emergency services are from seniors who have fallen? What are the most typical causes of falls identified by emergency personnel? Collecting and analyzing data like this will help expand our understanding of falls incidence and risk.
- **Letter carriers:** Canada Post letter carriers already note trip hazards on their routes; the purpose of this is for the protection of their own personnel. Some of this information could help B.C. communities – particularly those with a high proportion of senior residents – identify and repair environmental risks.
- **Acute, Long-term Care and Community Incident Report Forms:** Reporting systems already in place for the collection of information on falls could be adapted to assist in designing prevention strategies.

  A falls surveillance tool for long-term care facilities is currently being tested in British Columbia. When the final version is completed later this year, it is recommended that it be adopted in all licensed and registered assisted living facilities, along with appropriate training and data support.
- **Health Authorities:** Falls data are already being collected by health authorities; these should be used to help design and evaluate effective fall prevention strategies.

- **Municipal governments:** Local municipal authorities collect information on reports of slips, trips and falls that occur within their jurisdiction. This information could be used to plan for safer pedestrian routes and to design routes that are tailored to the needs of older pedestrians and those with disabilities.
- **National Ambulatory Care Reporting System (NACRS):** As described earlier in this report, NACRS is a new data collection system being spearheaded by the Canadian Institute for Health Information to capture information on patient visits to hospital and community-based ambulatory care. If this data collection system was applied to emergency departments across B.C., it would provide invaluable evidence about the prevalence and incidence of fall-related injuries in B.C., including the pre-event circumstances prior to the injury. Such a system would be an essential tool for evaluating various injury prevention strategies.

ROLE FOR THE PRIVATE SECTOR

Aging individuals have unique needs that often go unmet by the marketplace. There are many initiatives and products that entrepreneurs, businesses or organizations could develop and promote which could lead to improved choices for the elderly and could potentially decrease the impact of falls. These include:

- As one ages, it becomes increasingly difficult to put on shoes and tie them up; this often means seniors are relegated to shuffling about in slippers. Shoe manufacturers need to see the opportunities in making comfortable, safe, attractive non-slip footwear that are affordable, easy to tie up, and are also wide and deep enough to accommodate foot irregularities due to arthritis, corns, etc.
- For active seniors with mobility problems there is a need for assistive devices that look less institutional. A lightweight, collapsible "walking stick" with hand straps – such as those used by hikers – promotes an image of vitality and vigor as opposed to the heavy, wooden cane typically associated with old age and frailty.
- Starting and maintaining an appropriate exercise program is often difficult for people of any age, let alone the elderly. Health clubs and community organizations should focus on creating fun and affordable exercise programs geared to the elderly. Personal trainers and private physiotherapists should offer in-home, supervised or tailored exercise programs for aging clientele. Other potentially-mobile services, such as opticians or shoe stores, could offer home visits, thus filling a niche for the frail senior with declining mobility.
- The home construction industry needs to support initiatives, such as user-friendly homes, that promote simple building code design changes encouraging structures that allow aging in place and also reduce the risk of falls or injuries. Simple, cost-efficient designs at the time of construction – such as widening doors, removing thresholds or putting solid wooden framing in the walls around a bathtub so that grab bars can be installed in the future if needed – can save thousands of dollars in retrofitting and prevent the need for an elderly occupant to move into long-term care. Programs about home décor and design on TV and home renovation retail outlets are currently very popular; there is a role for creating programming and products that cater to the design and renovation of seniors' homes, aimed at preventing falls and promoting safety as people functionally age and decline.

6. Recommendations from the Provincial Health Officer

The preceding pages illustrate the huge toll of falls and fall-related injuries among the elderly population of British Columbia. Each year, thousands of seniors are having their quality of life and health undermined by falls, with hundreds dying either directly or indirectly from falls. Yet there is convincing research evidence that some strategies can be highly effective – particularly those focused on falls assessments followed by appropriate interventions, as well as exercise programs tailored to increase strength, balance and flexibility.

It is clear that preventing falls and the resulting injuries among the elderly must become a public health priority. The following are recommendations from the Provincial Health Officer concerning actions that various groups and individuals can take to reduce the number and consequences of falls in the province. These recommendations incorporate suggestions from workshops held within the five B.C. Health Authorities.

It is important to note that while we pinpoint the actions that should be taken by certain groups of individuals, such as physicians and pharmacists, everyone who has contact with seniors should be encouraged to work together to find ways to reduce the risk of a fall and any resulting injury. This means not only targeting prevention strategies through health care workers, but also involving those who design, build and maintain buildings, private homes and public settings, and those who provide transportation or other services frequently used by the elderly. Most of all, prevention strategies must include the active involvement of seniors' organizations, and seniors themselves, in the design, implementation and evaluation of falls prevention programs. If seniors themselves have an active hand in the design of initiatives, this will help to tap into seniors' "insider" knowledge and will enhance receptiveness to those initiatives.

Physicians can provide leadership and have a vital role in carrying out clinical assessments of fall risks. However, they should not be seen as the only leaders of fall prevention initiation. Physiotherapists, occupational therapists, nurses, and nurse practitioners often effectively initiate this role. The evidence points to multidisciplinary teams as being most effective.

There is also an important role for other health workers in the team, such as pharmacists, dieticians, optometrists, community health workers, podiatrists and emergency service workers. Acute care facilities, regional health authorities, and the municipal, provincial and federal governments all have a role to play in helping reduce the incidence of falls. Recommendations for these sectors are included in this report.

Most importantly, prevention strategies must include the active involvement of seniors themselves in the design, implementation and evaluation of falls prevention programs. Seniors have "insider" knowledge and therefore, will be more receptive to initiatives if they have an active hand in their design.

PHYSICIANS

Physicians, particularly family physicians, are often among elderly patients' first contacts with the health system and doctors have the primary role in monitoring the health of an older person and helping initiate important fall prevention strategies:

RECOMMENDATION 1: Family physicians should assess gait and balance on a routine basis, and specifically ask their elderly patients about any falls that may have occurred (see Appendix D). For those patients who have experienced a fall or who show signs of gait and balance difficulties, a full risk assessment should be carried out, followed by appropriate intervention or referral to specialists or other appropriate members of the health care team. The recently published EPIDOS screening tool for hip fracture risk is recommended to physicians as a screening tool for women over 75 (see page 61).

RECOMMENDATION 2: Continuing Medical Education activities should include workshops and training for family doctors in how to conduct falls risk assessments for elderly patients.

RECOMMENDATION 3: Wherever possible, physicians should encourage appropriate strength and mobility exercises, such as Tai Chi, to help at-risk patients reduce their risk of falls, or the patient should be referred to appropriate resources for the provision of exercise programs.

RECOMMENDATION 4: All physicians should minimize the prescription of all medications with side effects known to contribute to an increase in falls (for example, benzodiazepines, muscle relaxants, antidepressants) among the elderly and be alert to the combinations of drugs that are most highly associated with increased risk of falling. In particular, all physicians must minimize their prescriptions for benzodiazepines in the elderly population and warn their patients about the association of serious falls with benzodiazepine use. Wherever possible, they should support the careful withdrawal of these medications. Patients should be referred to a geriatrician for help in reducing medication if the family physician feels they are not able to achieve this.

RECOMMENDATION 5: All physicians should warn elderly patients with short-term serious illnesses or those who suffer from chronic diseases that the effects of illness and bed rest are associated with an increased risk of falling. In particular, when prescriptions are given for medications such as anti-infectives, cardiac drugs and psychotropic medication, physicians should warn these patients about the increased risk of falling due to their medical condition and/or side effects of the medication; physicians should also provide advice designed to reduce the risk.

RECOMMENDATION 6: Physicians are encouraged to involve other physicians and professionals – for example, occupational therapists, physiotherapists, geriatricians and neurologists – in comprehensive falls assessments of elderly people. Information on how to obtain falls risk assessment tools can be found on the BC Injury and Prevention Unit Web site at www.injuryresearch.bc.ca.

RECOMMENDATION 7: Physicians are encouraged to make available, through their own offices, public education information on the prevention of falls –for example, B.C. "Health Files" #78 (January 2001) – See Web site at www.bchealthguide.org/healthfiles/hfile78.stm.

PHARMACISTS

The pharmacists of B.C. are able to monitor the use of medications among elderly persons, and to consult with both patients and physicians about ways to reduce the risk of falling.

RECOMMENDATION 8: Seniors should be encouraged to talk to pharmacists about medication use and those medications or combinations that might contribute to falls.

RECOMMENDATION 9: Pharmacists should distribute advice to patients about possible drug effects causing predisposition to falls and efforts patients can make to reduce the risk, particularly in relation to the combination of prescription drugs and alcohol.

RECOMMENDATION 10: Pharmacists should alert physicians when their patients have been prescribed drugs, or combinations of drugs, that are known to increase the risk of falls.

RECOMMENDATION 11: Pharmacies should be encouraged to continue to market effective products that prevent falls or injuries from falls, such as protective devices (hip pads) and walking aids.

RECOMMENDATION 12: Pharmacists should develop stickers that warn "May increase the risk of falling" which are applied to all prescription medications known to have side effects linked to higher rates of falls.

RECOMMENDATION 13: Pharmacists should arrange for any printed advice provided with medications to be in sufficiently large typeface for ease of reading by those with diminished vision.

MANAGERS OF LONG-TERM CARE FACILITIES

Since it is estimated that there are on average 1.5 falls per year for every bed in long-term care, it is essential that long-term care homes take steps to reduce the rates of falls among their residents. These recommendations should also be reviewed by the operators of homes registered as "assisted living" under the *Community Care and Assisted Living Act.*

RECOMMENDATION 14: Facilities should establish monthly surveillance and maintain a record (database) of the incidence of falls in their facilities. At regular staff meetings, a review can then be carried out to determine what preventive measures can be initiated as a result of this surveillance. A falls surveillance tool for long-term care facilities is currently being tested in British Columbia. When the final version is completed later this year, it is recommended that it be adopted in all licensed and registered assisted living facilities, along with appropriate training and data support.

RECOMMENDATION 15: Detailed falls assessments should be carried out upon a resident's admission to a facility, at regular intervals, and/or when the health of the resident changes. Assessments should be followed by appropriate interventions such as medication reviews, exercise programs, and transfer training. See the B.C. Injury Research and Prevention Unit Web site at www.injuryresearch.bc.ca for information on reliable assessment tools.

RECOMMENDATION 16: The use of hip protectors should be encouraged in long-term care homes and among the frail elderly or those with osteoporosis living in the community.

RECOMMENDATION 17: Facilities should call upon the expertise of physiotherapists and occupational therapists to assist in falls prevention for individuals or as part of program development.

COMMUNITY HEALTH WORKERS/ HOME CARE NURSES AND OTHER PROVIDERS OF SERVICES IN SENIORS' HOMES

Many of B.C.'s frail elderly continue to live at home and since most falls occur in the home, staff of home support agencies and health care services are important first line agents in the identification and reduction of the risk of falls.

RECOMMENDATION 18: Initial intake assessments for home support clients should be conducted by those with training in assessing and screening for level of fall risk and contributing factors to prior falls. This information should be used to design a fall prevention protocol to be included in the client care plan. Community health workers, home care nurses, physiotherapists and occupational therapists and other providers of services in seniors' homes should include in their on going training the conducting of on going falls risk screening and encouragement to refer elderly clients to appropriate services for more detailed assessments and interventions. Those with specialized training in safe mobility and environmental modifications, such as physiotherapists and occupational therapists, should be supported in applying their knowledge and intervention skills.

RECOMMENDATION 19: Where a hazardous environment in the home is identified as a fall risk, personnel or programs should be developed to address the home modifications and help the elderly make environmental changes for a reasonable cost. This includes accessing funding from such programs as the Home Adaptations for Seniors Independence (HASI) program of CMHC.

ACUTE CARE HOSPITALS

After admission to an acute care hospital and the month following discharge from hospital are times of heightened risks for falls among the elderly.

RECOMMENDATION 20: Acute care hospitals should establish an admission screening procedure on fall risk for all elderly patients based on prior fall history, prior fall injuries, and problems with mobility, vision and cognition. For those found to be at risk, a detailed falls assessment should be conducted shortly after admission. These should be updated with changing health conditions and steps to be taken to reduce identified risks outlined in the patient care plan. In addition, in-house fall and fall injury surveillance should be routinely conducted with the help of Risk Managers to identify the location and pre-fall circumstances of falls that are occurring within the hospital to enable hospital-wide implementation of preventive and quality improvement measures.

RECOMMENDATION 21: Detailed falls assessments should be conducted when elderly patients are discharged from hospital. Identified risk factors should be followed up with appropriate medical, exercise or environmental intervention.

HEALTH RESEARCHERS

The field of falls prevention research is relatively new and there is much more research required to fully understand which strategies are best suited to at-risk seniors, and which strategies will prove the most effective over the long-term. In addition, fall prevention programs that may have been shown to be effective in other regions should be evaluated in different settings (urban and rural) in

B.C. to be sure they are providing the expected benefits.

RECOMMENDATION 22: Health researchers should be encouraged to investigate some of the outstanding questions surrounding fall prevention strategies, as outlined in section 5 of this report. Investigation into the association of drugs and falls should be examined in greater detail.

RECOMMENDATION 23: Health research funding agencies should be encouraged to fund well-designed, multi-factorial interventions rather than favoring studies of single causative agents for falls, one variable at time. The single agent study may not always be an appropriate model, given the complexity of falls risks and prevention. In order to obtain adequate subject numbers and add research power to the study, health funding agencies should encourage the partnering of funds for falls prevention research.

REGIONAL HEALTH AUTHORITIES

Regional health authorities are in a position to collect data to help us better understand the risk and impact of falls in their region, across all sectors of the health care delivery system and in the community. Health authorities are in a position to work with other organizations in the region to develop, implement and evaluate the effectiveness of targeted fall prevention programs and to respond to the educational needs of health workers wanting to enhance their roles in creating safer environments for our aging population.

RECOMMENDATION 24: Regional Health Authorities have access to untapped data about falls in acute care, long-term care and from people receiving home support services. These data should be collected, collated and used to design and evaluate fall prevention strategies and quality of care improvement programs. Regional Health Authorities should implement the NACRS surveillance system in the emergency department of their hospitals to collect and analyze the incidence, prevalence and cause of various injuries in their regions including the pre-event circumstances that lead to an injury from a fall.

RECOMMENDATION 25: Regional Health Authorities should consider adding specific falls assessments to any clinic currently in place – such as Geriatric Assessment clinics or influenza vaccination clinics. Assessments should include basic mobility tests, vision checks, medication reviews and questions about prior falls and contributing factors. Handouts could follow on prevention strategies and contact information on local resources such as the seniors' exercise programs, reliable home modification contacts, equipment "Loan Cupboards", etc. Red Cross "Loan Cupboards" are available in each Regional Health Authority for seniors or those with disabilities requiring equipment (such as canes, walkers, grab bars, hip protectors) to try out or to use on a short term basis prior to obtaining their own supplies. It is recommended that Regional Health Authorities continue to support and expand these facilities in collaboration with the Red Cross.

RECOMMENDATION 26: In order to build regional capacity for implementing falls prevention programs and activities, Regional Health Authorities should work with community partners such as municipalities (particularly Municipal Engineers), recreation centers, seniors' organizations and existing falls prevention programs that are sponsored by other organizations. Activities to

promote include safety and access improvements in public places, home modifications, and exercise programs tailored to the needs and abilities of the elderly, particularly those focusing on balance, strength and flexibility. Health Authorities should partner with the Veterans Affairs Canada/Health Canada projects in their areas to utilize and build on the knowledge and experience gained by these community-based initiatives over nearly three years of work in falls prevention (see Appendix E for listing of projects).

RECOMMENDATION 27: Regional Health Authorities should provide learning opportunities for their health employees on the best practices for designing, implementing and evaluating falls prevention programs. This can be done through in-services, training sessions, conferences, or through recommended changes to existing curricula of local colleges and universities. In addition, Regional Health Authorities should consider sponsoring workshops, such as those carried out in Capital Health, Edmonton focusing seniors in all settings – the well and frail elderly living at home, those in supportive housing or rehabilitation facilities, and those in long-term care and acute care settings – to identify local actions that can be taken to prevent falls and injuries in the elderly (see box on page 67).

MINISTRIES OF HEALTH SERVICES AND HEALTH PLANNING

What is measured gets managed. The Ministries of Health Services and Health Planning should consider adding outcome measures for falls reduction among seniors. Possible measures could include reductions in emergency room visits and hospital admissions for injuries due to falls among those aged 65 years and older.

RECOMMENDATION 28: The Ministry of Health Services should mandate the use of the National Ambulatory Care Reporting System (NACRS) in all emergency departments in British Columbia to improve the data collection, analysis and reporting of this increasingly important activity in health care. This will enable the collection of information on some of the pre-event circumstances that lead to injuries resulting from falls.

RECOMMENDATION 29: The Ministry of Health Planning should encourage B.C. Ambulance Service to enhance their ability to extract data from their existing surveillance system to better identify pre-fall circumstances and post-fall outcomes for elderly persons who receive emergency services for fall-related events, and to use these data to put forward recommendations for emergency-based fall and injury prevention programming. In addition, B.C. Ambulance Service should be encouraged to relay information on the conditions contributing to the fall to the appropriate health care providers for follow-up.

RECOMMENDATION 30: The Ministry of Health Planning should explore mechanisms within Primary Care Practice to encourage comprehensive, multidisciplinary models of care for seniors that include fall risk assessment and prevention protocols.

RECOMMENDATION 31: The Ministry of Health Planning should include the prevention of falls in the elderly in their Chronic Disease Management five-year comprehensive work plan.

Appendix A: Acknowlegements

The Provincial Health Officer is grateful for the many contributors who attended five workshops to discuss a summary of the information presented in this report and to provide input to the draft recommendations. Over three hundred participants attended the workshops held for the North, Interior, Fraser, Vancouver Coastal and Vancouver Island Health Authorities. Many of the suggestions heard from the participants have been incorporated into the recommendations.

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Jan Appleton
Public Health Nursing Assistant
Administrator
Interior Health Authority

Lillian Baaske
Acting Program Manager
Health Canada

Mary Bates
Senior Operating Officer
Interior Health Authority

Andrea Berkes
Administrative Assistant
Office of the Provincial Health Officer

Joanne Boomer
Executive Administrative Assistant
Office of the Provincial Health Officer

Mariana Brussoni
BC Injury Research & Prevention Unit

Martha Burd
Senior Manager, Person-Specific Records
Information Support
Ministry of Health Services

Marcia Carr
Coordinator of Acute Geriatric Care
Fraser Health Authority

Janet Carter
A/Director
Policy and Program Analysis
Ministry of Health Services

Tanya Cherriman
Program Manager, Public Health Nursing
Northern Health Authority

Jim Cruickshank
Information Consultant
Information Support
Ministry of Health Services

Dr. Terry Curran
Neurologist
Vernon

Laurie Darrah
Muze Creative

Derek Daws
Managing Director
BC Drug & Poison Information Centre

Veronica Doyle
Regional Director
Vancouver Island Health Authority

Dr. Bob Fisk
Director Epidemiology
Ministry of Health Planning

Dr. Elaine Gallagher
Centre on Aging
University of Victoria

Tessa Graham
Director & Special Advisor
Office of Women's & Seniors' Health
Ministry of Health Planning

Dr. Scott Garrison
Family Physician
Richmond

Ramsay Hamdi
Economist
Ministry of Health Services

Effie Henry
Executive Director
Performance Management &
Improvement Division
Ministry of Health Services

Zhila Kashaninia
Research Officer
Business Planning, Surveillance &
Epidemiology

Dr. Karim Khan
Department of Family Practice
University of British Columbia

Bonnie Lillies
Community Developer
Vancouver Coastal Health Authority

Sandra McKenzie
Director of Residential Care
Langley & Surrey Extended Care Unit

Tom MacLeod
Project Coordinator
Community and Seniors Services

Marnie Mitchell
Executive Director
PharmaCare

Anne Mullens
Healthcare Communications Consultant
Victoria

Dr. Shaun Peck
Deputy Provincial Health Officer

Dr. Howard Platt
Medical Consultant
Medical Services Plan

Dr. Gerry Predy
Medical Officer of Health
Edmonton

Dr. Duncan Robertson
Geriatric Consultant

Dr. Hugh Robinson
Family Physician
Vancouver

Dr. Stephen Robinovitch
School of Kinesiology
Simon Fraser University

Dr. Ted Rosenburg
Geriatric Services
Royal Jubilee Hospital

Dr. Larry Rubenstein
Professor of Geriatric Medicine
UCLA School of Medicine

Dr. Vicky Scott
Senior Advisor, Falls Prevention
BC Injury Research and Prevention Unit

Fiona Sudbury
Clinical Nurse Specialist
Aberdeen Hospital

Shew Wai Teo-Cheong
Senior Research Officer/Managing Editor
Office of the Provincial Health Officer

Simon Troop
Muze Creative

Wendy Vander Kuyl
Research Assistant
Business Planning, Surveillance
and Epidemiology
Ministry of Health Planning

Dr. Don Voaklander
Associate Professor
Department of Rural & Remote Health
University of Northern British Columbia

Appendix B: Web sites and References

Alberta Centre for Injury Control and Research
www.med.ualberta.ca/acicr

American Geriatrics Society: Position Paper on Falls Prevention
http://www.americangeriatrics.org/products/positionpapers/Falls.pdf

British Columbia Injury Research and Prevention Unit
www.injuryresearch.bc.ca

British Columbia Ministry of Health Planning – Health Files
http://www.bchealthguide.org/healthfiles/index.stm or http://www.bchealthguide.org/healthfiles/hfile78.stm

Canadian Health Network
www.canadian-health-network.ca

Canadian Institute for Health Information
www.cihi.ca

Canadian Medical Association and CMA Journal
http://www.cmaj.ca/

Canadian Public Health Association
www.cpha.ca

Centers for Disease Control and Prevention CDC) – National Center for Injury Prevention and Control – Fall Facts
http://www.cdc.gov/ncipc/duip/spotlite/falfacts.htm

Centre for Studies in Aging, University of Toronto
http://www.swchsc.on.ca/~csia/

Community Health Research Unit (CHIRU), University of Ottawa
http://www.uottawa.ca/academic/med/epid/chru.html

Health Canada Division of Aging and Seniors
http://www.hc-sc.gc.ca/seniors-aines/

Joanna Briggs Research Institute
(The Joanna Briggs Institute is an International Research Collaboration for Evidence Based Health Care based at the Royal Adelaide Hospital and the Adelaide University)

www.joannabriggs.edu.au

Lord & Menz Australian Fall Web site
www.powmri.unsw.edu.au/FBRG/FBRGhome.htm

National Center for Injury Prevention and Control (US-NCIPC)
www.cdc.gov/ncipc/factsheets/falls.htm

Registered Nurses Association of Ontario: Prevention of Falls Best Practices Guide
www.rnao.org/bestpractices

Safe Communities
http://www.safecommunities.ca/

Safe USA
www.safeusa.org

Smart Risk Foundation
http://www.smartrisk.ca/

Statistics Canada: Animated Population Pyramid
http://www.statcan.ca/english/kits/animat/pybc.htm

United Kingdom Department of Health – Older People's National Framework
http://www.doh.gov.uk/nsf/olderpeople/index.htm

Vernon and Enderby Falls Project
www.spcno.bc.ca/seniors/falls

Veterans Affairs Canada – Falls Prevention Tips
http://www.vac-acc.gc.ca/clients/sub.cfm?source=health/falls/falltips

Victoria Falls Project
http://www.victoriafallsproject.com/home.shtml

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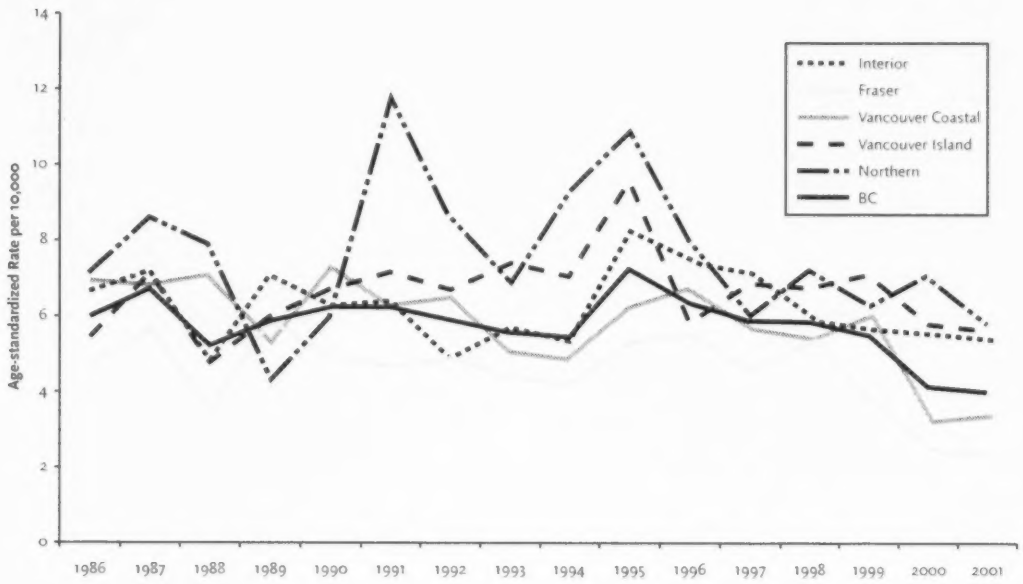
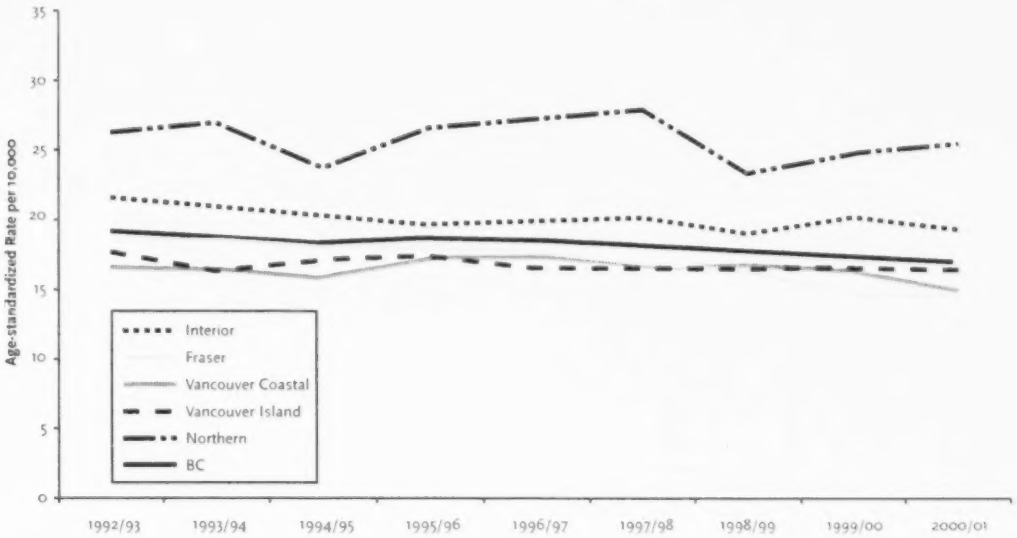
Appendix C: Regional Charts

DEATHS DIRECTLY DUE TO FALLS IN SENIORS AGED 65+ YEARS, BY HEALTH AUTHORITY, B.C., 1986 TO 2001



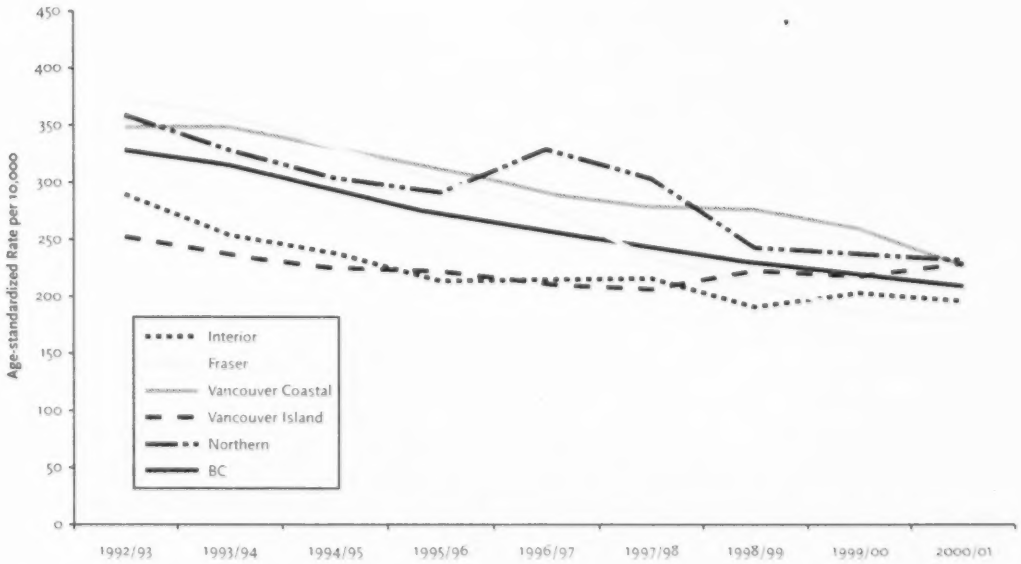
Source: B.C. Vital Statistics Agency

FALLS IN SENIORS, HOSPITAL CASES AGED 65+ YEARS, BY HEALTH AUTHORITY, B.C., 1992/93 TO 2000/01



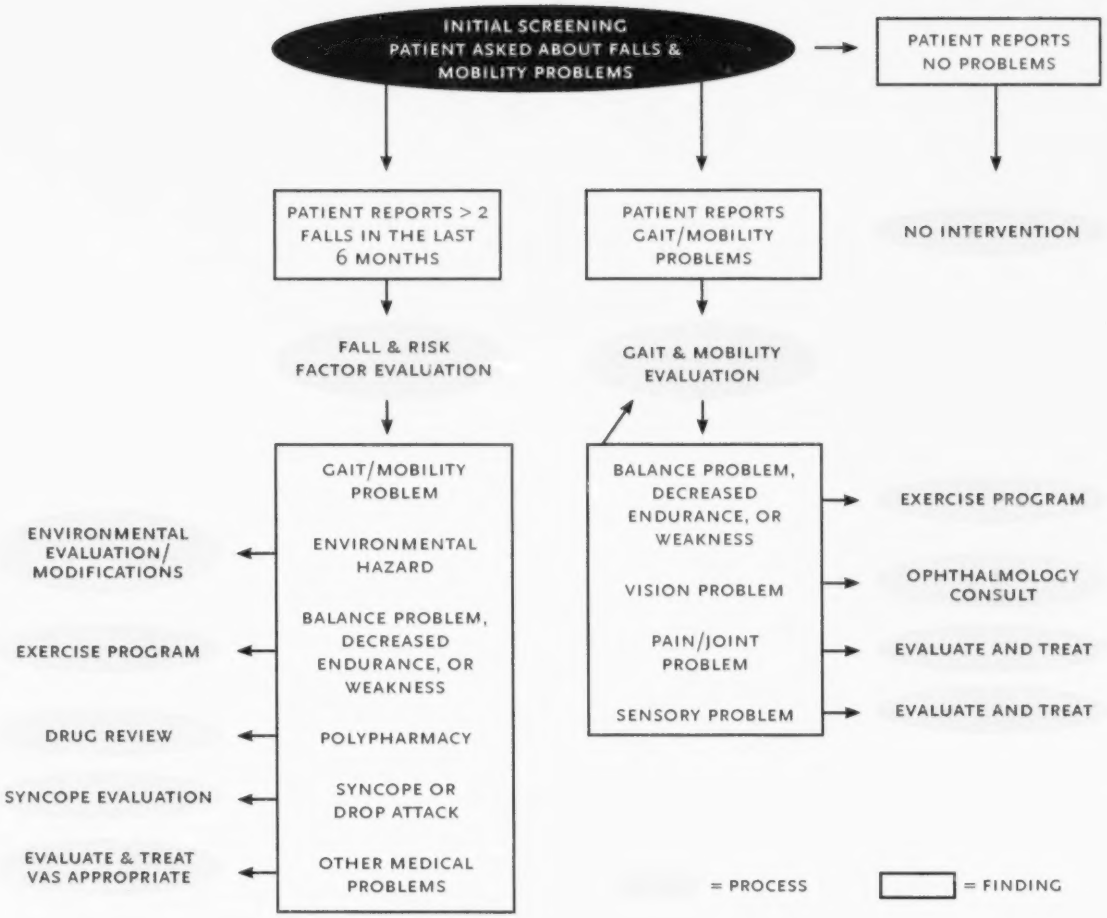
Source: Acute/reab. separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Dataset

FALLS IN SENIORS AGED 65+ YEARS, HOSPITAL DAYS, BY HEALTH AUTHORITY, B.C., 1992/93 TO 2000/01



Source: Acute/reab. separations from the 1992/93 to 2000/01 Canadian Institute of Health Information Discharge Abstract Dataset

Appendix D: Clinical Screening Guide for the Detection, Evaluation, and Intervention[1] of Falls and Mobility Problems



[1] Rubenstein, L.Z., Powers, C.M., & MacLean, C.H., (2000). Quality Indicators for Management and Prevention of Falls and Mobility Problems in Vulnerable Older Persons. Geriatric Research Education and Clinical Center, Greater Los Angeles Health Care System, Sepulveda, CA.

Appendix E: Veterans Affairs Canada/Health Canada falls prevention projects in BC

Stepping Out Together: Overcoming the Barriers to Change
Social Planning Council for North Okanagan, Vernon
Michael Vanderbeck
3205 31st Avenue
Vernon, BC V1T 2H2
Phone: 250-558-0040
Email: sirb@shawbiz.ca

South Island Region Falls Prevention Partnership Project
Vancouver Island Health Authority, Victoria
Laurie Brady-Mueller
540 Hoffman Avenue
Victoria, BC V9B 5W4
Phone: 250-744-4338
Email: lbmueller@shaw.ca

HC/VAC Falls Prevention Initiative
Fraser Health Authority, New Westminster
Gladys Brundrett
7978 Lakefield Drive
Burnaby, BC V5E 3W8
Phone: 604-525-5298
Email: gladbrundret@yahoo.com

Northern Health Board Veterans and Seniors Falls Prevention Initiative
Northern Health Authority, Prince George
Michael Gumpel
9985 Prodahl Road
Prince George, BC V2K 5M3
Phone: 250-967-4000
Email: mike_gumpel@telus.net

Watch Your Step! – A Coordinated Response to Falls Prevention
411 Seniors Centre Society
411 Dunsmuir Street
Vancouver, B.C., V6B 1X4
Phone: 604-684-8171
Email: ljensen@411seniors.bc.ca

These projects will be in operation until March 31, 2004.

For information on the evaluation of these initiatives after that date, please contact:

Lillian Baaske
Program Consultant
Population and Public Health Branch
Health Canada
440 - 757 West Hastings Street
Vancouver, B. C. V6C 1A1
Phone: 604-666-2778
Fax: 604-666-8986
Email: Lillian_Baaske@hc-sc.gc.ca